| | | | | | |
|---|---|---|---|---|---|
| PROJECT | : | BABELAN | DOCUMENT No. | : | WB1-101-000449_MAN7901 |
| CLIENT | : | AF Consult Ltd. | REVISION | : | - |
| PLANT LOCATION | : | Jakarta, Indonesia | DATE | : | 10/03/2016 |

# OPERATION & MAINTENANCE MANUAL

| | |
|---|---|
| **25.** | **Cleaning Water Pumps and Motor** |
| **SPX REF.** | **5720 - 5721** |
| **SUPPLIER** | **WEG, Speck** |
| **TAG N°** | **Unit 1: 1SDA10AP001**<br>**Unit 2: 1SDA10AP001** |

## CONTENT

| | Title | Bem n° | SPX doc. n° | Client Number |
|---|---|---|---|---|
| 1 | Cleaning Water Pump Datasheet | D0173747_A | DSH5720_A | BPS-1MAG-10055_01 |
| 2 | Cleaning Water Pump Motor Datasheet | D0173748_A | DSH5721_A | BPS-1MAG-10162_01 |
| 3 | Manifold Cleaning Water Pump | Z0886298_A | DWG5720_A | BPS-1MAG-10205_01 |
| 4 | Speck Pompen High Pressure Pumps Technical Documentation | | | |
| 5 | WEG IOM Manual of Electric Motors | | | |

| | | | | | |
|---|---|---|---|---|---|
| SPX COOLING TECHNOLOGIES | | **SPX Ref. Nr.** | **: WB1-101-000449_DSH5720 Rev.A** | | |
| **CLEANING WATER PUMP DATA SHEET** | | **File nr.** | **: D0173747_** | | |
| | | **AF Ref. Nr.** | **: BPS-1MAG-10055** | | |
| | | **Issued by** | **: ICA** | **Date** | **: 21/05/2015** |
| | | **Approved by** | **: CBR** | **Status** | **: For Purchase** |
| **BABELAN** | **AIR COOLED CONDENSER** | **Released by** | **: SFO** | | |

| Pos | Rev. | | | | | | | Rev. |
|---|---|---|---|---|---|---|---|---|
| | | **GENERAL** | | | | | | |
| 1 | A | MANUFACTURER | **Speck Triplex pumpen** | | QUANTITY REQUIRED per unit | **2 pump with 1 motor** | | |
| 2 | A | MODEL NR. | **P51/135-90** | | TOTAL ACC UNITS | **2** | | |
| 3 | | | | | ITEM / TAG NR. | **1SDA10AP001 (unit 1)** | | |
| 4 | | | | | | **2SDA10AP001 (unit 2)** | | |
| 5 | | **SITE DATA AND SERVICE CONDITIONS** | | | | | | |
| 6 | | INSTALLATION | **Outdoor** | | AMBIENT TEMPERATURE (min/max) | **+24 / 34** | **[°C]** | |
| 7 | | AREA CLASSIFICATION | **Non hazardous** | | RELATIVE HUMIDITY | **up to 100** | **[%]** | |
| 8 | | ATMOSPHERE TYPE | **Industrial, dusty, salty** | | | | | |
| 9 | | | | | | | | |
| 10 | | **OPERATING / DESIGN DATA FOR CLEANING PUMPS** | | | | | | |
| 11 | | OPERATING TEMPERATURE | **+5 / 34** | **[°C]** | RATED SPEED | **800** | **[rpm]** | A |
| 12 | | MAX. ALLOWABLE WATER TEMPERATURE | **52** | **[°C]** | ACTUAL PUMP SPEED | **800** | **[rpm]** | A |
| 13 | | MEDIUM (LIQUID) | **Service water** | | CRITICAL SPEED | **880** | **[rpm]** | A |
| 14 | | MECH. DESIGN TEMPERATURE | **60** | **[°C]** | MOTOR POWER ABSORBED | **45** | **[kW]** | A |
| 15 | | TOTAL FLOW PUMP | **2x140** | **[l/min]** | MOTOR POWER INSTALLED | **55** | **[kW]** | A |
| 16 | | REQ'D DYNAMIC SUCTION PRESSURE | **2 to 4** | **[barg]** | WEIGHT OF PUMP | **57** | **[kg]** | A |
| 17 | | PUMP DISCHARGE PRESSURE | **80** | **[barg]** | WEIGHT OF MOTOR | **496** | **[kg]** | A |
| 18 | | RELIEF VALVE SETTING PRESSURE | **88** | **[barg]** | WEIGHT OF SKID | **120** | **[kg]** | A |
| 19 | | REGULATOR VALVE SETTING PRESSURE | **80** | **[barg]** | | | | |
| 20 | | REQUIRED SUCTION LINE SIZE | **DN 80** | **[mm]** | | | | |
| 21 | | | | | | | | |
| 22 | | **CONSTRUCTION FEATURES** | | | | | | |
| 23 | | PLUNGERS | **3** | | **MATERIALS** | | | |
| 24 | | ROTATING DIRECTIONS | **as per direction arrow on pump** | | PLUNGER | **Ceramic** | | A |
| 25 | | DRIVER (E-MOTOR) | **as per WB1-101-000449_DSH5721** | | PACKING AREA | **Brass** | | A |
| 26 | | V-BELT TRANSMISSION | ***** | | FLUID MANIFOLD Inlet & Outlet | **Brass** | | A |
| 27 | | MANUFACTURER | ***** | | PUMP BODY | **Spherod. Cast iron** | | A |
| 28 | A | LUBRICATION | **Oil / Splash** | | CRANKSHAFT | **Case-hardened steel** | | A |
| 29 | A | GRADE OF OIL : | **ISO VG 220 or SAE 90** | | CONNECTING ROD | **Bronze** | | A |
| 30 | | | | | BASE PLATE | **Steel** | | A |
| 31 | | | | | ELASTOMERS | **NBR** | | A |
| 32 | | | | | V-PACKING | **nitrile w. fabric enforcing** | | A |
| 33 | | | | | | | | |

| Pos | Rev. | **ACCESSORIES** | **PAINTING** | |
|---|---|---|---|---|
| 35 | A | **A) PULSATION DAMPER TYPE LT0.35 5/8"UNF** | | |
| 36 | A | **B) PRESSURE REGULATOR VALVE TYPE VS450/200 (relief at 80bar)** | | |
| 37 | A | **C) RELIEF VALVE TYPE VS200/180 (relief at 88bar)** | | |
| 38 | | **D) PRESSURE GAUGE : 0-160 bar** | | |
| 39 | | **E) CAPTIVE ACCELERATION TUBES (as hoses)** | | |
| 40 | | **F) OIL IN CRANKCASE** | **Surface preparation : Blasting according to grade SA 2 1/2** | |
| 41 | | **G) STANDARD BOLT M12 DOWN SHOCK MOUNTS** | **Primer coat :** * * µm | |
| 42 | | **H) Hi-press Hose 1" (length : 1x3,5 m and 1x1,5 m)** | **Intermediate coat :** * * µm | |
| 43 | | **I) Tag number plates for pump, motor and accessories as per P&ID DWG0032** | **Final coat :** * * µm | |
| 44 | | | **Final colour : RAL 5018** | |

| Pos | Rev. | **REMARKS** | | |
|---|---|---|---|---|
| 46 | | | | |
| 47 | | **A) PACKING :** | **MANUFACTURER STANDARD** | |
| 48 | | **B) DELIVERY :** | **REFER TO PURCHASE ORDER** | |
| 49 | | **C) PROTECTION FOR 12 MONTHS OUTSIDE STORAGE REQUIRED** | | |

| | | |
|---|---|---|
| SPX COOLING TECHNOLOGIES<br>**(CLEANING WATER PUMPS) MOTOR DATA SHEET** | **SPX Ref : WB1-101-000449_DSH5721** | **Client : PT Cikarang Listrindo** |
| | **Revision : A** | **AF Ref. Nr : BPS-1MAG-10162** |
| | **File Nr : D0173748** | **Issued by : ICA** |
| **BABELAN** AIR COOLED STEAM CONDENSER | **Date : 21/04/2015** | **Approved by : PhDP** |
| | **Status : Prel** | **Released by : SFO** |

| Pos | Rev | | | | | Rev |
|---|---|---|---|---|---|---|
| | | **GENERAL DATA** | | | | |
| 1 | A | MANUFACTURER | : **WEG** | NUMBER OF UNIT REQUIRED | : **2 Units** | |
| 2 | A | MANUFACTURER'S REF. | : **SPX14-2276-DDrev1** | QUANTITY REQUIRED PER UNIT | : **1 per ACC** **(In total 2 motors)** | |
| 3 | A | MODEL NR./FRAME NR. | : **W22 250SM** | | | |
| 4 | A | DRAWING NR. | : **10002153847 (preliminary)** | ITEM -/TAGNR. | : **1SDA10 AP001 & 2SDA10 AP001** | |
| 5 | | | | | | |
| | | **SITE DATA / SERVICE CONDITIONS** | | | | |
| 6 | | LOCATION | : **Babelan** | RELATIVE HUMIDITY ATMOSPHERE ( % ) | : **60 up to 94** | |
| 7 | | | **Indonesia** | ATMOSPHERE TYPE | : **Industrial, dusty, salty, sea side** | |
| 8 | | INSTALLATION | : **Outdoor** | AMBIENT DESIGN TEMPERATURE (MIN/MAX) ( ° C ) | : **+24 / 34** | |
| 9 | | AREA CLASSIFICATION | : **Non hazardous** | AMBIENT OPERATING TEMPERATURE ( ° C ) | : **31** | |
| 10 | | ALTITUDE ABOVE SEALEVEL (m) | : **3** | | | |
| | | **OPERATING DESIGN DATA DRIVEN MACHINE** | | | | |
| 11 | | DRIVEN MACHINE - MOTOR | : **V-BELTS** | DRIVEN MACHINE TYPE | : **PLUNGER** | |
| 12 | | OTHER DATA | : **PUMP VENDOR TO INFORM** | ARRANGEMENT PUMP / MOTOR | : **HORIZONTAL ON SKID** | |
| 13 | | | | | | |
| 14 | | | | | | |
| 15 | | | | | | |
| 16 | | | | | | |
| | | **OPERATING DESIGN DATA MOTOR** | | | | |
| 17 | | MOTOR TYPE | : **SQUIRREL CAGE INDUCTION TYPE** | NETWORK CHARACTERISTICS | | |
| 18 | | DESIGN CODE(S) | : **IEC 60034** | POWER SUPPLY (V) | : **380** | |
| 19 | | OTHER DESIGN CODES/SPEC. | : **High efficiency IE2** | FREQUENCY (Hz) | : **50** | |
| 20 | | FRAME MATERIAL | : **Cast Iron** | NR OF PHASES | : **3** | |
| 21 | | SERVICE FACTOR | : **Continuous** | EARTHING METHOD | : **TN-S** | |
| 22 | | SERVICE DUTY | : **S1** | NETWORK VARIATION RANGES | | |
| 23 | | SPEED | : **SINGLE** | VARIATION OF VOLTAGE | : **- 15 % / + 10 %** | |
| 24 | A | RATED ( SYNCHR. ) SPEED (RPM) | : **1500** | VARIATION OF FREQUENCY | : **+ 5 / - 5 %** | |
| 25 | A | RATED OUTPUT (kW) | : **55** | VARIATION OF VOLTAGE & FREQ. | : **+ 10 % / - 10 %** | |
| 26 | | NUMBER OF POLES | : **4** | STARTING VOLTAGE (.... % Un.) | : **80** | |
| 27 | | INSULATION CLASS | : **F** | STARTING METHOD: | : **DIRECT ON LINE** | |
| 28 | | TEMPERATURE RISE CLASS | **B** | | | |
| 29 | | MIN.NUMBER OF CONSECUTIVE STARTS | | WOUND : | : **SINGLE WINDINGS** | |
| 30 | A | WARM | : **3** | | | |
| 31 | A | COLD | : **3** | DIRECTION OF ROTATION | : **CLOCKWISE/COUNTERCLOCK** | |
| 32 | | MIN.NUMBER OF STARTS / HOUR | | (FACING OUTGOING SHAFT) | | |
| 33 | A | WARM | : **3** | | | |
| 34 | A | COLD | : **3** | | | |
| 35 | | | | LOCATION MAIN TERMINAL BOX | : **Top** | A |
| 36 | A | MOUNTING ARRANGEMENT | : **B3T - IM 1001** | TERMINAL BOX TYPE | : **Turnable in 4 directions** | |
| 37 | | | : **HORIZONTAL** | ENCLOSURE CLASS MAIN TERMINAL BOX (IP) | : **IP 66** | A |
| 38 | A | EXTENDED SHAFT POSITION: | : **Both sides** | CABLE ENTRANCE | : **BOTTOM/TOP/LEFT/RIGHT** | |
| 39 | A | ENCLOSURE CLASS MOTOR (IP) | : **IP 55** | TERMINALS | : **FIXED MOUNTED BLOCKS WITH PROVISIONS FOR** | |
| 40 | | VENTILATION & COOLING | : **IC 411 TEFC** | | **GROUNDING AND CABLE GLANDS** | |
| 41 | | BALANCING CLASS | : **Normal (EN 60034-14)** | TERMINALS MARKING | : **IEC** | |
| 42 | | VIBRATION CLASS | : **Normal (EN 60034-14)** | CABLE GLAND | : **NOT REQUIRED** | |
| 43 | | BEARING LIFETIME L-10 (hours) | : **> 75000 h** | CABLE GLAND SIZE | : **NA** | |
| 44 | A | BEARING TYPE | : **Ball anti friction** | FEEDING CABLE SIZE | : **-** | |
| 45 | A | BEARING TYPE DRIVE END | : **6314-C3** | FEEDING CABLE TYPE | : **-** | |
| 46 | A | BEARING TYPE N - DRIVE END | : **6314-C3** | GROUNDING CONNECTION | : **YES REQUIRED** | |
| 47 | A | LUBRICATION | : **mobil polyrex EM** | GROUNDING CONNECTION TYPE | : **Internal connection box +** | |
| 48 | A | LUBRICATION INTERVAL. | : **11000** | | **casing** | |
| 49 | A | KEYWAY / ACCORDING CODE | : **Open** | BOX CABLE GLAND THREAD SIZE | : **2 x M63*1.5** | A |
| 50 | | NAMEPLATE TYPE / CODE | : **STAINLESS STEEL / IEC34** | | | |

BEM: D0173748_A_ORI.pdf

# SPX COOLING TECHNOLOGIES

# (CLEANING WATER PUMPS) MOTOR DATA SHEET

**BABELAN** AIR COOLED STEAM CONDENSER

| | | | |
|---|---|---|---|
| **SPX Ref** | : WB1-101-000449_DSH5721 | **Client** | : PT Cikarang Listrindo |
| **Revision** | : A | **AF Ref. Nr** | : BPS-1MAG-10162 |
| **File Nr** | : D0173748 | **Issued by** | : ICA |
| **Date** | : 21/04/2015 | **Approved by** | : PhDP |
| **Status** | : Prel | **Released by** | : SFO |

## ACTUAL MOTOR DATA

| | | | | FULL LOAD | 3/4 LOAD | 1/2 LOAD | 1/4 LOAD | NOMINAL LOAD | |
|---|---|---|---|---|---|---|---|---|---|
| 51 | A | RATED POWER AT MOTOR SHAFT | (kW): | 55 | 41,25 | 27,5 | 13,75 | 42 | A |
| 52 | A | CURRENT AT RATED VOLTAGE | (A) : | 108 | 88 | 68 | 52 | 88 | A |
| 53 | A | EFFICIENCY AT RATED VOLTAGE | (%): | 93,5 | 93 | 92,5 | | 93 | A |
| 54 | A | POWER FACT. (cos f) at rated voltage | (%): | 83 | 80 | 71 | | 80 | A |
| 55 | A | ACTUAL SPEED | (RPM): | 1475 | 1482 | 1488 | 1495 | 1482 | A |
| 56 | A | STARTING CURRENT RATIO | (Is / In): | < 6 | | | | | |
| 57 | A | NOMINAL TORQUE | (Nm): | 356 | 266 | 176 | 88 | 271 | A |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 58 | A | TORQUES AT RATED VOLTAGE | STARTING | (Nm): | 997 | | | | | |
| 59 | A | | PULL UP / OUT | (Nm): | 712 | ACCELERATION TIME | AT 100% Un/ FULL LOAD | (sec): | * | |
| 60 | A | | LOCKED ROTOR | (Nm): | 854 | | AT 80% Un/ FULL LOAD | (sec): | * | |
| 61 | A | LOCKED ROTOR CURRENT (100% Un) | | (A): | 648 | MOMENT OF INERTIA MOTOR ( I = mr2 ) | | (kgm2): | 0,843 | A |
| 62 | | LOCKED ROTOR CURRENT (80% Un) | | (%): | * | MOTOR WEIGHT | | (kg): | +/-496 | A |
| 63 | A | MAXIMUM LOCKED ROTOR CURRENT in % of full load curren | | (% ): | 600 | SOUND PRESSURE LEVEL AT 1METER (motor) : | | | <85dB(A) | A |
| 64 | A | MAX. LOCKED ROTOR TIME (100% Un) | | (sec): | 10 | | | | | |
| 65 | | MAX. LOCKED ROTOR TIME (80% Un) | | (sec): | * | | | | | |
| 66 | | | | | | | | | | |
| 67 | | | | | | | | | | |

## MOTOR ACCESSORIES

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 68 | | STANDSTILL SPACE HEATER | : | YES REQUIRED | AUXILIARY TERMINAL BOX | : Yes required | |
| 69 | A | VOLTAGE / QUANTITY | (V): | 220 / 2 | FOR CONNECTION OF | : space heaters | |
| 70 | A | POWER | (kW): | 0,56 | LOCATION AUXILIARY TERMINAL BOX | : Top / Side | |
| 71 | | TEMPERATURE DETECTORS | | | TERMINAL BOX TYPE | : Turnable in 4 direction | |
| 72 | | IN WINDINGS | : | NOT REQUIRED | ENCLOSURE CLASS AUX. TERMINAL BOX | (IP) : IP 66 | A |
| 73 | | TYPE / QUANTITY | : | - / - | CABLE ENTRANCE | : * | |
| 74 | | AT DRIVE END BEARING | : | NOT REQUIRED | TERMINALS : | FIXED MOUNTED BLOCKS WITH PROVISIONS FOR | |
| 75 | | TYPE / QUANTITY | : | - / - | | GROUNDING AND CABLE GLANDS | |
| 76 | | AT N-DRIVE END BEARING | : | NOT REQUIRED | TERMINALS MARKING | : IEC | |
| 77 | | TYPE / QUANTITY | : | - / - | CABLE GLAND | : Not required | |
| 78 | | TROPICALIZATION | : | YES REQUIRED | CABLE GLAND THREAD | : - | |
| 79 | | WINTERIZATION | : | NOT REQUIRED | CONNECTION CABLE SIZE | : - | |
| 80 | | CONDENSATE DRAINS | : | YES REQUIRED | CONNECTION CABLE TYPE | : - | |
| 81 | | RAINSHIELD | : | NOT REQUIRED | GROUNDING CONNECTION | : - | |
| 82 | | LIFTING LUGS (AT LEAST 2) | : | YES REQUIRED | GROUNDING CONNECTION TYPE | : - | |
| 83 | | SPM NIPPLES | : | NOT REQUIRED | BOX CABLE GLAND THREAD SIZE | : 1 x M20* 1.5 | A |
| 84 | | | | | | | |

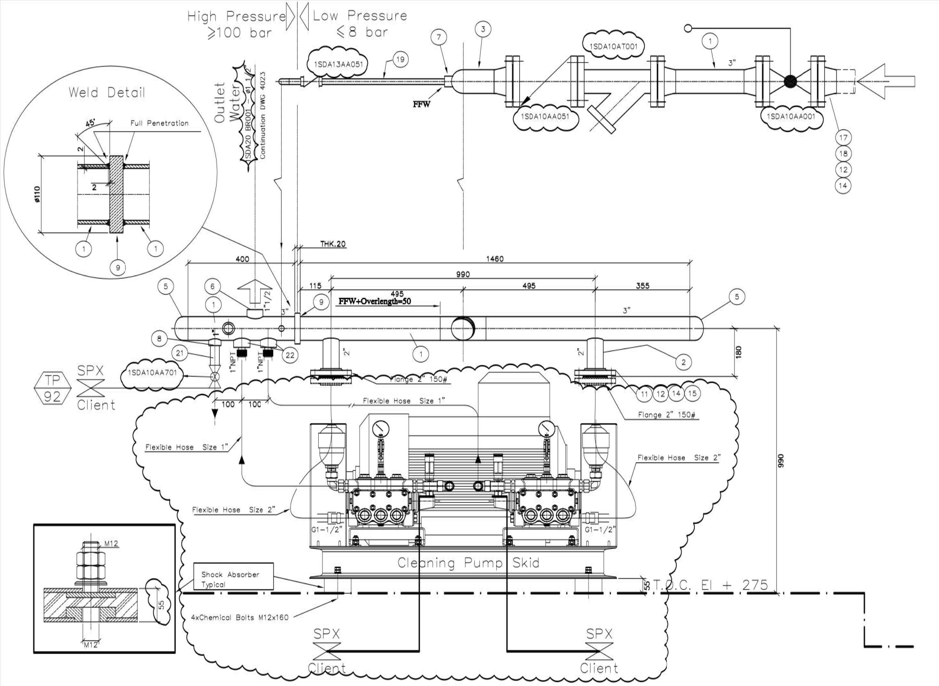
## PREPARATION FOR SHIPMENT AND STORAGE / DELIVERY

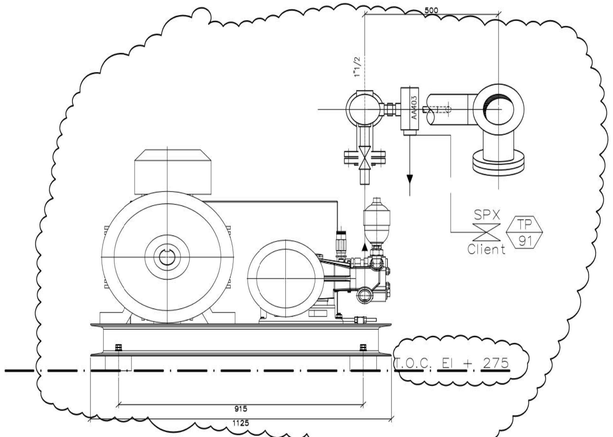
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 85 | | PAINTING SYSTEM | : | Manufacturer standards suitable for ambient conditions (corresponding to ISO 12944 corrision class C5) | | | | A |
| 86 | | SURFACE PREPARATION | : | Manufacuter standards suitable for ambient conditions | | | | |
| 87 | | | | PRODUCT NAME | COLOUR CODE | NR. OF LAYERS | DRY FILM THICKNESS | |
| 88 | A | PRIMER | : | zinc epoxy polyamide | brown | 1 | 75 | A |
| 89 | A | INTERMEDIATE COAT | : | epoxy polyamide | * | 1 | 100 | A |
| 90 | A | FINAL COAT | : | polyamide epoxy top coat | RAL 5009 | 1 | 100 | A |
| 91 | | TOTAL DFT THICKNESS | : | | | | min 275 | A |
| 92 | | PROTECTION FOR 12 MONTHS OUTSIDE STORAGE OF MACHINED / UNPAINTED PARTS / INTERNALS : | | | | | | |
| 93 | | PACKING | : | MANUFACTURER STANDARD | | | | |
| 94 | | MARKING | : | MANUFACTURER STANDARD | | | | |
| 95 | | DELIVERY | : | SEE PURCHASE ORDER | | | | |

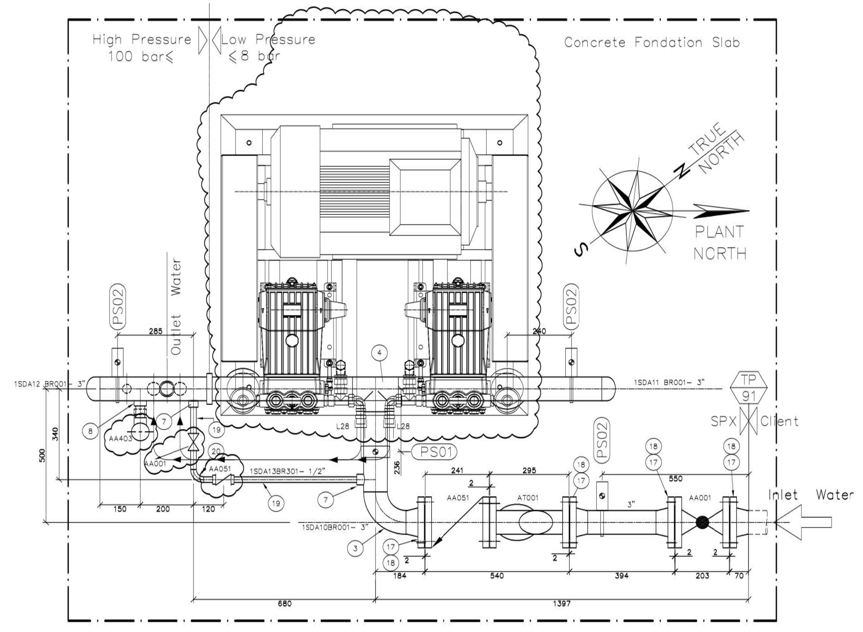
## REMARKS

| | | | | |
|---|---|---|---|---|
| 96 | | C E marking required | Tolerances according to EN 60034 | Partial load data are for information only |
| 97 | | The motors shall be conform to client specification : " Technical specification" (CIK-14000-801-10008 / AF-BB-BS2001) | | |

BEM: D0173748_A_ORI.pdf







## Pipe Support PS02

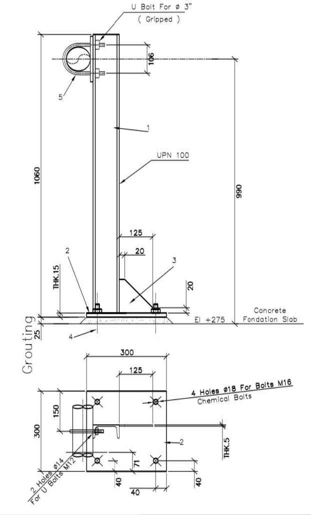
( 3x Required/per unit )

Support Steel Shapes

1_ UPN100 Total Length:1070
2_ Base Plate 300x300x15
3_ Gusset 125x125x5
4_ 4x Chemical Bolts M16

Standard Equipment Assembly :
Typical Carpenter And Paterson

5_ 1x U-Bolt (To Grip) for ø 3" Ref: Carpenter And Paterson Fig 283



## Pipe Support PS01

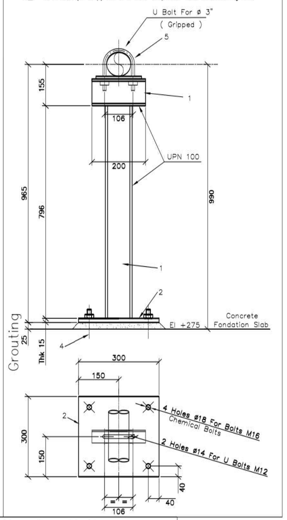
( 1x Required/per unit )

Support Steel Shapes

1_ UPN100 Total Length:1020
2_ Base Plate 300x300x15
4_ 4x Chemical Bolts M16

Standard Equipment Assembly :
Typical Carpenter And Paterson

5_ 1x U-Bolt (To Grip) For ø 3" Ref: Carpenter And Paterson Fig 283



Material List For One Unit

For Supporting

| Item | Description | Qty | Material |
|---|---|---|---|
| PS01 | Support For 3" Stainless Steel Pipes (See Detail) | 1 | CS |
| PS02 | Support For 3" Stainless Steel Pipes (See Detail) | 3 | CS |

Material List For One Unit

For Piping

| Item | Size | Description | Qty | Sch/Rating | Material |
|---|---|---|---|---|---|
| 1 | 3" | Pipe SMLS OD 88.9 X THK 5.49 | 2,5m | Sch 40S | A312TP304L |
| 2 | 2" | Pipe SMLS OD 60.3 X THK 3.91 | 0,5m | Sch 40S | A312TP304L |
| 3 | 3" | 90° LR Elbow –BW | 1 | Sch 40S | A403WP304L |
| 4 | 3" | Straight Tee –BW | 1 | Sch 40S | A403WP304L |
| 5 | 3" | Caps –BW | 2 | Sch 40S | A403WP304L |
| 6 | 1"1/2 | Half Coupling SW | 1 | #3000 | A182F304L |
| 7 | 1/2" | Half Coupling SW | 2 | #3000 | A182F304L |
| 8 | 1" | Half Coupling SW | 2 | #3000 | A182F304L |
| 9 | – | Blind Ring ø110 – Thk 20 | 1 | – | TP 304 L |
| 10 | | | | | |
| 11 | 2" | Klinger Sil C4500 Thk 2 MM | 2 | 150# | |
| 12 | – | Heavy Hex Nuts M16 | 56 | – | A194 Gr B8 |
| 13 | | | | | |
| 14 | – | Stud Bolt M16 X L 120mm | 28 | – | A193 Gr B8 |
| 15 | 2" | Slip On Flange | 2 | 150# | A182F304L |
| 16 | | | | | |
| 17 | 3" | WN Flange RF | 4 | 150# | A182F304L |
| 18 | 3" | Klinger Sil C4500 Thk 2 MM | 5 | 150# | |
| 19 | 1/2" | Pipe SMLS OD 21.3 X THK 2.77 | 1.2m | Sch 40S | A312TP304L |
| 20 | 1/2" | 90° LR Elbow –BW | 1 | Sch 40S | A403WP304L |
| 21 | 1" | Pipe SMLS OD 33.4 X THK 3.38 | .25m | Sch 40S | A312TP304L |
| 22 | 1"NPT | Half Coupling Screwed | 2 | #3000 | A182F304L |

Valid for Unit 1 & 2

| Ver. | Date | Name | Remark | Status |
|---|---|---|---|---|
| – | 11.08.2014 | GT | FOR CONSTRUCTION | CFC |
| A | 28.05.15 | DDU | REVISED SEE CLOUDS | CFC |
| B | – | – | – | – |
| C | – | – | – | – |
| D | – | – | – | – |
| E | – | – | – | – |

PRE = PRELIMINARY | CTD = CERTIFIED DRAWING | CFC = CERTIFIED FOR CONSTRUCTION | ASB = AS BUILT

| | | | |
|---|---|---|---|
| **Project Id.**<br>WB1-101-000449 | **Codeword**<br>Babelan, Indonesia | **Customer**<br>PT.Cikarang Listrindo/AF Consult | |
| **Product Item Id.**<br>– | **Product Item Designation**<br>AIR COOLED CONDENSER | | |

| | Date | Name |
|---|---|---|
| **Drawn** | 11.08.2014 | GT |
| **Checked** | . | DM |
| **Released** | . | SFO |

Copyright acc. to ISO 16016

**Document Designation**
Manifold Cleaning Water Pump
–

**Content/Key**
DWG 5720

SPX
COOLING TECHNOLOGIES

| Projection | Scale | Document Id. | Ver. | Page |
|---|---|---|---|---|
| | 1:10 | Z0886298 | A | – |
| | **Format** A2 | **BOM Id.** – | **Item Id.** – | |

REFERENCE DRAWING & SPECIFICATION

| DRAWING No. | DRAWING TITLE |
|---|---|
| | |

NOTES

EL. +0.00 = EL. +4100 LWS

| REV. | DESCRIPTION | DATE | DRAWN | CHECK'D | APPR'D |
|---|---|---|---|---|---|
| 03 | | | | | |
| 02 | | | | | |
| 01 | REVISED SEE CLOUDS | 28.05.2015 | DDU | DM | SFO |
| 00 | FOR CONSTRUCTION | 11.08.2014 | GT | DM | SFO |

PT. CIKARANG LISTRINDO
POWER COMPANY

ÅF-Consult
www.afconsult.com

SPX
COOLING TECHNOLOGIES

PROJECT
COAL FIRED POWER PLANT BABELAN
AIR COOLED CONDENSER

DRAWING TITLE

**Manifold Cleaning Water Pump**

CLIENT'S DOC CODE

| SCALE | DESIGN | DRAWN | CHECKED | APPROVED |
|---|---|---|---|---|
| | | | | |

CONTRACTOR'S DOC. CODE **BPS-1MAG-10205** REV. 01

# SPECK TRIPLEX

# HOCHDRUCK PUMPEN

# HIGH-PRESSURE PUMPS

100 Years
1909 | 2009

SPECK

Diese

Dokumentations-Datei

wurde mittels Leerseiten

so konzipiert dass sie

2-seitig ausgedruckt

werden kann

This

documentation file

was designed with

blank pages

for 2-sided print

# SPECK-TRIPLEX-PUMPEN

## Technical Documentation

## High-Pressure Pump Unit

**No. 600911**
(please quote with your remittance)

**Order No.**
**(SPX)3201001846**

**Application:** **Cleaning**

**Performance data:**

| | | |
|---|---|---|
| Media | Water | |
| Media temperature | 52 | °C |
| Output | 2x134 | l/min |
| Outlet pressure max. | 80 | bar |
| Pumping rotating speed | 800 | 1/min |
| Required power | 45,23 | kW |
| Required inlet pressure | 0,5-1,5 | bar |

**Pump:** **SPECK-TRIPLEX-PLUNGER PUMP P51/135-90**

**driven by:** **Electric motor 55 kW**

**The unit is completely assembled and tested.**

**All performance data mentioned above is related to clear cold water.**
**Warranty claims only with original Speck spare parts.**

# High-pressure pump unit - Index

1 High-pressure pump unit
    - Part list

2 High-pressure pump unit
    - Operating instructions and safety regulations

3 Pump
    - Operating instructions (standard configuration)
    - Spare part list

4 Motor
    - Operating, maintenance, technical data and safety instructions

5 Belt drive
    - Instructions
    - Data Fe und te

6 Pressure relief valve
    - Operating instructions (standard configuration)
    - Spare part list

7 Relief valve
    - Operating instructions (standard configuration)
    - Spare part list

8 2-Way ball valve
    - Technical data
    - Operating instructions

9 Pulsations damper (Accumulator)
    - Technical data
    - Operating instructions

10 Final Inspection / Test specification / Test report

11 Dimension sheet power unit

12 Declaration of incorporation of partly completed machinery
    - EC directive 2006/42/EC on machinery

**SPECK-TRIPLEX-PUMPEN**
**GmbH + Co.KG**

| | | | |
|---|---|---|---|
| **Part List HP-Unit** | | | **AB-No.: 600911** |
| Output: | 2x134 l/min | Temp. (Medium): 52 °C | Power, required: 45,23 kW |
| Pump Revol.: | 800 rpm | Media: Water | |
| Pressure, input: | 0,5-1,5 bar | Application: Cleaning | |
| Pressure, outp.: | 80 bar | | |

| Pos. | Part No. | Part Description | Technical Specification | Notes, Comments (external) | Qty. |
|---|---|---|---|---|---|
| 1 | 00.5088 | Pump | P51/135-90;<br>Materials: Brass/Nitril | Coated C5 RAL 5018 turquoise blue | 2 |
| 2 | 50.0001 | Electric motor | 55 kW; 3~; 380 V; D; 50 Hz; 4-pol.; Size 250S/M; B3; IP55; Iso F; IE2 | | 1 |
| 3 | 50.0008 | Taper bushing motor disc | 2517 / Ø60; | Shaft end fan side; | 1 |
| 4 | 50.0008 | Taper bushing motor disc | 2517 / Ø65; | Shaft end opposite fan side; | 1 |
| 5 | 19.0281 | Taper bush. pump disc | 3020 / Ø35; | | 2 |
| 6 | 19.0225 | V-Belt-Disc motor | 3SPB Ø160 / 2517; | | 2 |
| 7 | 19.0301 | V-Belt-Disc pump | 3SPB Ø280 / 3020; | | 2 |
| 8 | 07.3922 | V-belts | XPB Lw1600 | | 6 |
| 9 | 12.6700 | Pressure relief valve | VS 200/180;<br>Materials: Brass/Nitril;<br>Release pressure: 88 bar; | Bypass free blow-off | 2 |
| 10 | 50.0017 | Pressure relief valve | VS450/200<br>Materials: Brass/Nitril;<br>Release pressure: 80 bar; | separately attached | 1 |
| 11 | 31.0012 | Pressure Gauge | Ø63; 0-160bar; G1/4 oil dampened;<br>Connection downwards;<br>Stainless steel/Brass; | mounted on middle pressure valve plug | 2 |
| 12 | 50.0054 | Check valve | Ball valve; PN130; DN8; G1/4;<br>Material: Stainless steel; | Shut-off valve for gauge | 2 |
| 13 | 12.0101 | Pulsations damper | DS350/150 0,35l<br>Materials: Stainless steel/Nitril;<br>Precharging: 48 bar; | installed on high pressure side | 2 |
| 14 | 50.0072 | High-pressure hose, ext. | 2SN; PN160; DN25; L=2m;<br>DKOL0°-28L-1" NPTF;<br>Material: Edelstahl; | Connection pump - pressure hose (on site) | 2 |
| 15 | 50.0071 | Low-pressure hose, ext. | PN10; DN50; L=1,5m; G1½;<br>Flange B16,5;G2<br>Material: Stainless steel/Brass | Connection inlet - pumps | 2 |

| | | | | | |
|---|---|---|---|---|---|
| **Part List HP-Unit** | | | | **AB-No.: 600911** | |
| Output: 2x134 l/min | | Temp. (Medium): 52 °C | | Power, required: 45,23 kW | |
| Pump Revol.: 800 rpm | | Media: Water | | | |
| Pressure, input: 0,5-1,5 bar | | Application: Cleaning | | | |
| Pressure, outp.: 80 bar | | | | | |

| Pos. | Part No. | Part Description | Technical Specification | Notes, Comments (external) | Qty. |
|---|---|---|---|---|---|
| 16 | 50.0022 | Mounting plate / Base frame | Steel frame;<br>Material: Steelplate; | with belt - tensioning device and belt cover; C5 coating RAL 7005 mouse grey, belt cover C5 RAL 1003 signal yellow | 1 |
| 17 | 07.3449 | Rubber-metal connection | Ø100x40mm IG/AG M16; | | 4 |
| 18 | 50.0050 | Accessory | Grounding lug; | | 2 |

# ORIGINAL BETRIEBS- UND MONTAGEANLEITUNG FÜR HOCHDRUCKPUMPENAGGREGAT

# ORIGINAL OPERATING AND FITTING INSTRUCTIONS FOR THE HIGH-PRESSURE PUMP UNIT

SPECK

## 1. Allgemeines

SPECK Hochdruckpumpenaggregate werden nach Kundenangaben anwendungsspezifisch aufgebaut. Die auf dem Deckblatt der Dokumentation ausgewiesenen Aggregatdaten können daher von den Angaben auf dem Pumpentypenschild abweichen

Für die Inbetriebnahme, Wartung und Instandsetzung von Pumpe, Sicherheitseinrichtung (Sicherheitsventil, Unloader) Antriebsmotor etc. gelten die entsprechenden Einzelbetriebsanleitungen.

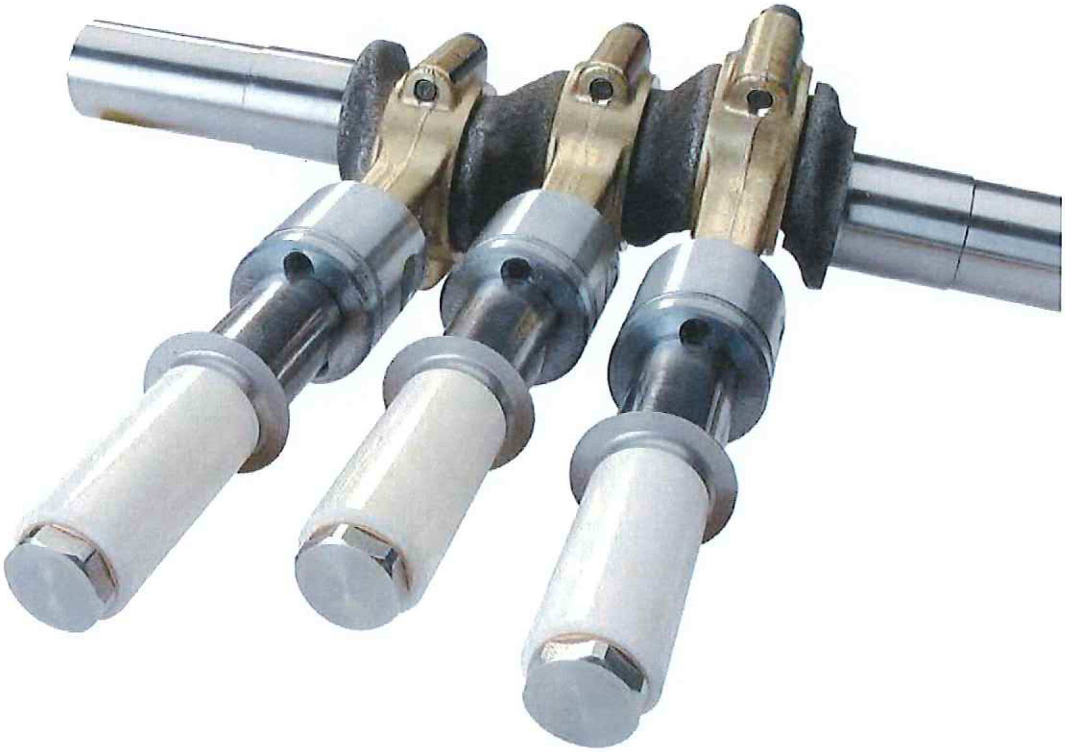
Diese Betriebsanleitung enthält lediglich Hinweise zum Aufbau des Aggregates innerhalb der Gesamtinstallation.

## 1. In General

SPECK high-pressure pump units are constructed in accordance with customer specifications to suit particular applications. The pump unit data documented on the cover page can therefore differ to the information shown on the pump name-plate.

The individual operating instructions apply for the operation, maintenance and service of the pump, safety devices (safety valve, unloader), driving motor etc.

This set of operating instructions contains directions relevant only for the assembly of the unit within the whole installation.



## 2. Sicherheit

Diese Betriebsanleitung enthält grundlegende Hinweise, die bei Aufstellung, Betrieb und Wartung zu beachten sind. Daher ist diese Betriebsanleitung unbedingt vor Montage und Inbetriebnahme vom Monteur sowie dem zuständigen Fachpersonal / Betreiber zu lesen und muss ständig am Einsatzort der Maschine/Anlage verfügbar sein.

Es sind nicht nur die unter diesem Hauptpunkt Sicherheit aufgeführten allgemeinen Sicherheitshinweise zu beachten sondern auch die unter den anderen Hauptpunkten eingefügten speziellen Sicherheitshinweise, so z.B. für den privaten Gebrauch.

### 2.1 Kennzeichnung von Hinweisen in der Betriebsanleitung

Die in dieser Betriebsanleitung enthaltenen Sicherheitshinweise, die bei Nichtbeachtung Gefährdungen für Personen hervorrufen können,

sind mit allgemeinem Gefahrensymbol

⚠ Sicherheitszeichen nach DIN 4844-W9

bei Warnung vor elektrischer Spannung mit

⚠ Sicherheitszeichen nach DIN 4844-W8

besonders gekennzeichnet.

Bei Sicherheitshinweisen, deren Nichtbeachtung Gefahren für die Maschine und deren Funktionen hervorrufen kann, ist das Wort

**Achtung!** eingefügt.

Direkt an der Maschine angebrachte Hinweise, wie z.B.

- Drehrichtungspfeil
- Kennzeichen für Fluidanschlüsse

müssen unbedingt beachtet und in vollständig lesbarem Zustand gehalten werden.

### 2.2 Personalqualifikation und -schulung

Das Personal für Bedienung, Wartung, Inspektion und Montage muss die entsprechende Qualifikation für diese Arbeiten aufweisen. Verantwortungsbereich, Zuständigkeit und die Überwachung des Personals müssen durch den Betreiber genau geregelt sein. Liegen bei dem Personal nicht die notwendigen Kenntnisse vor, so ist dieses zu schulen und zu unterweisen. Dies kann, falls erforderlich, im Auftrag des Betreibers der Maschine durch den Hersteller/Lieferer erfolgen. Weiterhin ist durch den Betreiber sicherzustellen, dass der Inhalt der Betriebsanleitung durch das Personal voll verstanden wird.

### 2.3 Gefahren bei Nichtbeachtung der Sicherheitshinweise

Die Nichtbeachtung der Sicherheitshinweise kann sowohl eine Gefährdung für Personen als auch für Umwelt und Maschine zur Folge haben. Die Nichtbeachtung der Sicherheitshinweise kann zum Verlust jeglicher Schadensersatzansprüche führen.

Im einzelnen kann Nichtbeachtung beispielsweise folgende Gefährdungen nach sich ziehen:

- Versagen wichtiger Funktionen der Maschine/Anlage
- Versagen vorgeschriebener Methoden zur Wartung und Instandhaltung
- Gefährdung von Personen durch elektrische, mechanische und chemische Einwirkungen
- Gefährdung der Umwelt durch Leckage von gefährlichen Stoffen

## 2. Safety

This Operation Manual gives basic instructions which are to be observed during installation, operation and maintenance of the pump. It is therefore imperative that this manual be read by the responsible personnel / operator prior to assembly and commissioning. It is always to be kept available at the installation site.

It is not only the general safety instructions contained under this main heading Safety that are to be observed but also the specific information provided under the other main headings.

### 2.1 Identification of Safety Instructions in the Operating Manual

Safety instructions given in this manual, non-compliance with which would affect safety,

are identified by the following symbol:

⚠ see DIN 4844 - W9

or where electrical safety is involved, with

⚠ see DIN 4844 - W8

Safety measures which can cause damage to the machine if not adhered to, are marked

**Important!**

It is imperative that signs affixed to the machine, e.g.

- arrow indicating the direction of rotation
- symbols indicating fluid connections

be observed and kept legible

### 2.2 Qualification and Training of Operating Personnel

The personnel responsible for operation, maintenance, inspection and assembly must be adequately qualified. Scope of responsibility and supervision of the personnel must be defined exactly by the plant operator. If the staff does not have the necessary knowledge, they must be trained and instructed, which may be performed by the machine manufacturer or supplier on behalf of the plant operator. Moreover, the plant operator is to make sure that the contents of the operating manual are fully understood by the personnel.

### 2.3 Hazards in the Event of Non-Compliance with the Safety Instructions

Non-compliance with the safety instructions may produce a risk to the personnel as well as to the environment and the machine, and results in a loss of any right to claim damages.

For example, non-compliance may involve the following hazards:

- Failure of important functions of the machine/plant
- Failure of specified procedures of maintenance and repair
- Exposure of people to electrical, mechanical and chemical hazards
- Endangering the environment owing to hazardous substances being released.

## 2.4 Sicherheitsbewußtes Arbeiten

Die in dieser Betriebsanleitung aufgeführten Sicherheitshinweise, die bestehenden nationalen Vorschriften zur Unfallverhütung sowie eventuelle interne Arbeits-, Betriebs- und Sicherheitsvorschriften des Betreibers sind zu beachten.

## 2.5 Sicherheitshinweise für den Betreiber / Bediener

- Führen heiße oder kalte Maschinenteile zu Gefahren, müssen diese Teile bauseitig gegen Berührung gesichert sein.
- Berührungsschutz für sich bewegende Teile (z.B. Kupplung) darf bei sich in Betrieb befindlicher Maschine nicht entfernt werden.
- Leckagen (z.B. der Wellendichtung) gefährlicher Fördergüter (z.B. explosiv, giftig, heiß) müssen so abgeführt werden, dass keine Gefährdung für Personen und die Umwelt entsteht. Gesetzliche Bestimmungen sind einzuhalten.
- Gefährdung durch elektrische Energie sind auszuschließen (Einzelheiten hierzu siehe z.B. in den Vorschriften des VDE und der örtlichen Energieversorgungsunternehmen).

## 2.6 Sicherheitshinweise für Wartungs-, Inspektions- und Montagearbeiten

Der Betreiber hat dafür zu sorgen, dass alle Wartungs-, Inspektions- und Montagearbeiten von autorisiertem und qualifiziertem Fachpersonal ausgeführt werden, das sich durch eingehendes Studium der Betriebsanleitung ausreichend informiert hat.

Grundsätzlich sind Arbeiten an der Maschine nur im Stillstand durchzuführen. Pumpen oder -aggregate, die gesundheitsgefährdende Medien fördern, müssen dekontaminiert werden.

Unmittelbar nach Abschluss der Arbeiten müssen alle Sicherheits- und Schutzeinrichtungen wieder angebracht bzw. in Funktion gesetzt werden.

Vor der Wiederinbetriebnahme sind die im Abschnitt Inbetriebnahme aufgeführten Punkte zu beachten.

## 2.7 Eigenmächtiger Umbau und Ersatzteilbestellung

Umbau oder Veränderungen der Maschine sind nur nach Absprache mit dem Hersteller zulässig. Originalersatzteile und vom Hersteller autorisiertes Zubehör dienen der Sicherheit. Die Verwendung anderer Teile kann die Haftung für die daraus entstehenden Folgen aufheben.

## 2.8 Unzulässige Betriebsweisen

Die Betriebssicherheit der gelieferten Maschine ist nur bei bestimmungsgemäßer Verwendung entsprechend Abschnitt 1 -Allgemeines- der Betriebsanleitung gewährleistet. Die im Datenblatt angegebenen Grenzwerte dürfen auf keinen Fall überschritten werden.

### Zitierte Normen und andere Unterlagen

| | |
|---|---|
| DIN 4844 Teil 1<br>Beiblatt 13 | Sicherheitskennzeichnung;<br>Sicherheitszeichen W8 |
| DIN 4844 Teil 1<br>Beiblatt 14 | Sicherheitskennzeichnung;<br>Sicherheitszeichen W9 |

## 2.4 Safe Operation

When operating the pump, the safety instructions contained in this manual, the relevant national accident prevention regulations and any other service and safety instructions issued by the plant operator are to be observed.

## 2.5 Safety Instructions for Operator

- If hot or cold machine components involve hazards, they must be guarded against accidental contact.
- Guards for moving parts (e.g. coupling) must not be removed from the machine while in operation.
- Any leakage of hazardous (e.g. explosive, toxic, hot) fluids (e.g. from the shaft seal) must be drained away to prevent any risk to persons or the environment. Statutory regulations are to be complied with.
- Hazards arisng from electrical energy are to be eliminated (see, for example, the VDE Specifications and the by-laws of the local power supply utilities).

## 2.6 Safety Instructions Relevant for Maintenance, Inspection and Assembly Work

It shall be the plant operator's responsibility to ensure that all maintenance, inspection and assembly work is performed by authorized and qualified persons who have adequately familiarized themselves with the subject matter by studying this manual in detail.

Any work on the machine shall only be performed when it is at a standstill.

Pumps and pump units which convey hazardous media must be decontaminated.

On completion of work, all safety and protective facilities must be re-installed and made operative again.

Prior to restarting the machine, the instructions listed under 'Operation' are to be observed.

## 2.7 Unauthorized Alterations and Production of Spare Parts

Any modification to the machine can only be made with the manufacturer's permission. Using spare parts and accessories authorized by the manufacturer is in the interest of safety. Use of other parts may exempt the manufacturer from any liability.

## 2.8 Unauthorized Modes of Operation

The reliability of the delivered machine will be only guaranteed if it is used in the manner intended, in accordance with clause 1 -In General- of this manual. The specified limit values in the data sheet must under no circumstances be exceeded.

### Pending Standards and other Data

| | |
|---|---|
| DIN4844 Part 1:<br>supplement sheet 13 | Safety descriptions and<br>safety signs W8 |
| DIN4844 Part 1:<br>supplement sheet 14 | Safety descriptions and<br>safety signs W9 |

## 3. Transport und Lagerung

Das Aggregat ist waagerecht zu transportieren. Längere Zwischenlagerung in einer Umgebung mit hoher Luftfeuchtigkeit und Temperaturen unter dem Gefrierpunkt ist zu vermeiden.

Der Lagerraum sollte belüftbar sein, denn Schwitzwasser schadet dem Motor.

## 4. Aufstellung und Anschluss

⚠ Das Aggregat ist auf einem waagerechten, festen Fundament (Betonsockel) aufzustellen.
Der Aufstellungsort ist so zu wählen, dass der Keilriemenantrieb und die Pumpe für Wartungsarbeiten leicht zugänglich sind.

### 4.1 Pumpe

- Der Anschluss der Saug- und Druckleitung (siehe Maßblatt der Pumpe) ist mittels elastischen Schläuchen auszuführen, so dass keine Leitungskräfte auf die Pumpe übertragen werden.

**a) Saugleitung:**

- Entsprechend der Wassertemperatur auf der Saugseite ist der statische Druck so auszulegen, dass NPSHA immer größer ist als NPSHR der Pumpe (siehe Betriebsanleitung). Gegebenenfalls muss in die Saugleitung (zwischen Kondensatbehälter und Hochdruckpumpe) eine Kreiselpumpe installiert werden, die den notwendigen Vordruck für einen kavitationsfreien Betrieb der Hochdruckpumpe sichert.
- Die Nennweite der Saugleitung muss mindestens in der Größe des Pumpenanschlusses, besser eine Nummer größer, ausgeführt werden. Keine Filter oder Schieber unmittelbar vor dem Saugeingang der Pumpe installieren. Die Leitung soll nur zur Versorgung der Pumpe dienen, Abzweigungen zu anderen Verbrauchern oder Zapfstellen sind zu vermeiden.
- Bei Installation mehrerer Aggregate muss vom Vorlaufbehälter jedes Aggregat mit einer eigenen Saugleitung gespeist werden. Die Saugleitung zur Pumpe soll vom Vorlaufbehälter stetig fallen, ohne enge Winkel und Bögen verlegt werden (siehe grundsätzliche Aufbauempfehlung für Mehrpumpenanlagen).

- Bei Anschluss der Pumpe an das örtliche Wassernetz sind die örtlichen Vorschriften der Versorgungsunternehmen zu beachten. Zur Dämpfung der Saugpulsation ist vor der Hochdruckpumpe ein Saugstromstabilisator einzubauen (siehe hierzu grundsätzliche Aufbauempfehlungen).

**b) Druckleitung:**

- Unmittelbar hinter dem Druckausgang der Hochdruckpumpe muss eine Überdrucksicherung in die Druckleitung installiert werden. Zwischen Pumpe und Überdrucksicherung dürfen sich keine Absperrorgane befinden. Die Bypassleitung kann in den Vorlaufbehälter zurückgeführt oder ins Freie abgeführt werden.

**Achtung!** Leitung so verlegen, dass niemand durch plötzlich austretendes heißes oder aggressives Medium verletzt werden kann. Die Bypassleitung darf keine Absperrorgane haben.

- Bei Rückführung in den Kondensatbehälter darauf achten, dass Lufteinwirbelung vermieden wird.

- Möglichst nahe an der Pumpe sollte eine Entlüftungsmöglichkeit in die Druckleitung eingebaut werden.
- Vorzugsweise ist ein Manometer zwischen Pumpe und Überdrucksicherung zu installieren. Hierfür kann auch der zweite Druckausgang am Pumpengehäuse verwendet werden.
- Die Druckleitung ist von der Pumpe aus möglichst waagerecht oder stetig steigend zu verlegen.

## 3. Transport and Storage

The pump unit should always be transported horizontally. Storage for any length of time in a humid place or where temperatures are below zero is to be avoided.

The storage room must be well-ventilated as otherwise dampness will damage the motor.

## 4. Set-Up and Installation

⚠ The pump unit is to be mounted onto a level and solid foundation (cement base).
The place of installation has to be chosen so that maintenance work to the V-belt drive and pump head can be carried out easily.

### 4.1 Pump

- An elastic hose must be used for the connection of the suction and discharge line (see technical drawing of pump) so that any forces coming from the pipeline cannot be transferred to the pump.

**a) Suction Line**

- In accordance with the water temperature on the suction side, the static pressure must be fixed so that the NPSHA is always higher than the pump NPSHR (see operating instructions). If necessary, a booster pump is to be built into the suction line (between header tank and high pressure pump) which guarantees the required inlet pressure needed for cavitation-free operation.
- The nominal width of the suction line must be at least the same size as that of the pump connection thread, better still is one size larger. A filter or shut-off valve should not be installed directly in front of the suction inlet of the pump. The suction line is only be used to feed the pump and should not be branched off to other machines or taps etc.
- When installing more than one pump unit, each unit must be fed with its own separate suction line connected to the feeder tank. The suction line leading to the pump must fall steadily from the header tank and is to be installed without narrow elbow fittings and joints (see instructions for installation of manifold pump units).
- If the pump is connected to the local water supply, the regulations of the local water works must be adhered to. A suction stream stabilizer is to be fitted in front of the plunger pump to damp suction pulsation (please refer to principal assembly directions for multi-pump units).

**b) Discharge Line**

- A safety valve must be installed in the high pressure line directly after the discharge outlet of the pump. Shut-off fittings are not to be put between the pump and safety valve. The bypass line can be either feed back to the header tank or placed in the open.

**Important!** The bypass line is to be fitted in such a way that nobody can be injured by the sudden emergence of hot or corrosive medium. The bypass line must be free of any shut-off fittings.

- Make sure that air-turbulence does not occur when feeding back into the header tank.

- An air vent should be installed in the discharge line as near as possible to the pump.
- The most optimal place for installing a pressure gauge is between the pump and safety valve. The second outlet on the pump casing can also be used for this purpose.
- The discharge line is to be laid either horizontally or so that it rises steadily away from the pump.

### 4.2 Druckspeicher

- Der Druckspeicher, falls vorhanden, soll die Pulsation der HD-Pumpe dämpfen, um Vibrationen der Druckleitung zu vermeiden. Die Gasvorspannung des Druckspeichers soll 50-60% des maximalen Betriebsdruckes betragen. Die korrekte Gasvorspannung muss regelmäßig (ca. alle 2 Monate) kontrolliert werden (siehe Betriebsanleitung Druckspeicher).

### 4.3 Motor

⚡ ⚠ Der Anschluß des Motors ist unter Beachtung der Angaben in der Betriebsanleitung und dem Typenschild durchzuführen.

### 4.4 Schmutzfänger / Filter

- Den Filtereinsatz regelmäßig reinigen und auf Beschädigungen überprüfen (In Abhängigkeit von Medium und Einsatzdauer).

## 5. Inbetriebnahme

- Ölstand an der Pumpe kontrollieren und ggf. entsprechend der Betriebsanleitung auffüllen.
- Alle Schieber und andere Absperrorgane öffnen.
- Vor Inbetriebnahme die Ausrichtung Motor-Pumpe, sowohl bei Direktkupplung als auch bei Keilriemenantrieb überprüfen und ggf. korrigieren. Durch Transport, Setzen oder Recken der Bauteile könnte die Fluchtung beeinträchtigt sein.
- Antriebsmotor kurz starten, um die Drehrichtung zu kontrollieren. Beachten Sie die vorgeschriebene Drehrichtung der Pumpe (Pfeile auf dem Antriebsgehäuse). Die Pumpe darf zu diesem Zweck nur kurz (ca. 30sec) Trockenlaufen!
- Schutzhaube montieren.
- Wasserzulauf öffnen.
- Pumpe starten. Die Pumpe sollte sofort entlüften und die Wasserförderung einsetzen. Auf gleichmäßiges Laufgeräusch achten. Sollte die Pumpe unregelmäßig laufen bzw. der Druck stark pulsieren, so ist möglicherweise einer der drei Plunger nicht entlüftet. Pumpe dann mehrmals kurz an und ausschalten, um das Entlüften zu erleichtern. Entlüftungshahn in der Druckleitung öffnen, um das Entlüften zu erleichtern.

**Achtung!** Wenn heißes Wasser gefördert wird - **Verbrühungsgefahr**

## 6. Wartung und Instandhaltung

- Für Wartung und Instandhaltung der Pumpe beachten Sie bitte die entsprechenden Absätze in der Betriebsanleitung.
- Eine erste Überprüfung des Pumpenaggregates empfehlen wir nach 50 Betriebsstunden:

  a) Keilriemenspannung und -verschleiß prüfen.

  Die Ausrichtung Motor-Pumpe, sowohl bei Direktkupplung als auch bei Keilriemenantrieb überprüfen und ggf. korrigieren. Durch den Betrieb könnte die Fluchtung der Bauteile beeinträchtigt sein.

**Achtung!** Zu hohe Keilriemenspannung kann zu einem Dauerbruch der Kurbelwelle führen. Siehe in folgenden Vorschriften für das Spannen der Riemen

### 4.2 Pressure Accumulator

- The purpose of the pressure accumulator, if installed, is to damp pulsation of the high pressure pump and thus avoid vibrations in the discharge line. Gas in the pressure accumulator should be tensioned to 50-60% of the max. pump operating pressure. The correctly filled gas pressure must be checked regularly (approx. every 2 months). See operating instructions for pressure accumulator.

### 4.3 Motor

⚡ ⚠ The motor is to be connected as per the information stated in the operating instructions and shown on the name-plate.

### 4.3 Strainer / Filter

- Clean the filter insert regularly and check for any damage (based on the medium and operation period).

## 5. Operation

- Check oil level in pump, and if necessary fill up as described per operating instructions.
- Open all regulator valves and other shut-off fittings.
- Before putting into operation and regardless whether the unit is directly coupled or belt-driven, check the alignment of the pump and motor and correct if necessary. Alignment might have been affected during transport or over time.
- Start motor briefly to check the direction of rotation. Pay careful attention to the specified direction of rotation for the pump (arrows indicated on crankcase). To check the correct rotation, the pump must only be dry run for a short period (approx. 30 sec.).
- Fit protective covering.
- Open water feed line.
- Start pump. As there is a certain static pressure present in the suction line, the pump should be vented of air immediately and begin conveying water. Listen carefully for an smooth-running sound. If the pump begins to run irregularly or pulsate strongly, it can be that one of the three plungers is not vented. In this case, the pump should be started and stopped at quick intervals to ease venting. Venting is also made easier if the vent tap in the discharge line is opened.

**Important!** **Danger of scalding** when pumping hot water.

## 6. Maintenance and Repair

- When carrying out maintenance or repair work on the pump, the respective points shown in the operating instructions must be observed.
- We recommend that a first inspection of the pump unit be made after 50 hours of operation-

  a) check V-belt for correct tensioning and wear.

  Regardless whether directly coupled or belt-driven, check the alignment of the pump and motor and correct if necessary, as alignment can become affected over time.

**Important!** V-belt over-tensioning can lead to permanent damage of the crankshaft. Please see further instructions pertinent to the tensioning of V-belts.

b) Ölwechsel an der Pumpe gemäß Betriebsanleitung durchführen. Abwechselnd von dem Ölwechselintervall in der Betriebsanleitung (je nach Type 200/500h) kann das Wechselintervall bei reduzierten Druckbelastungen auf 1000h erhöht werden. Eine regelmäßige Kontrolle des Ölzustandes muss sichergestellt sein.

### 6.1 Weitere Wartungsmaßnahmen:

- Die Dichtungslebensdauer ist stark abhängig von den Betriebsbedingungen wie Wassertemperatur, Wasserzustand, Pumpendrehzahl und -druck.
- Es empfiehlt sich, die Pumpe regelmäßig auf Leckage zu kontrollieren. Einige Tropfen Leckage pro Minute sind zulässig, wenn dadurch keine Vermischung des Getriebeöles mit Wasser (zum Beispiel durch Verschleppen von Dampf in den Antrieb) auftritt. Bei größerer Leckage, die auch zu einem Druckabfall führen kann, sind die Dichtungen rechtzeitig zu erneuern.
- Insbesondere nach längerer Stillstandzeit oder beim Start der Pumpe mit kaltem Wasser kann Leckage auftreten. Diese verschwindet aber gewöhnlich fast vollständig, sobald die Dichtungen Feuchtigkeit aufgenommen haben bzw. durch warmes Wasser eine Quellung der Dichtungen eingetreten ist.
- Als weitere Verschleißteile gelten die Ventile. Die Oberflächen von Ventilsitz und Ventilplatte verschleißen aufgrund der hohen Ventilfrequenz und der Wasserbeschaffenheit. Verschlissene Ventile äußern sich in einem unregelmäßigen Förderstrom und Druckverhalten der Pumpe.
- Der Antrieb der Pumpe benötigt außer regelmäßiger Ölkontrolle keine besondere Wartung. Die Radialwellendichtringe und die Plungerdichtungen sind auf Ölleckage zu kontrollieren.

b) Change pump oil as indicated in the operating instructions. This must normally be done at intervals of between 200-500 h, depending on the model. However, the interval can be extended to 1000 h where working pressure is reduced. Oil checks are to be made regularly.

### 6.1 Further Steps for Correct Maintanence

- The service life of the seals depends largely on operating conditions such as water temperature, water constitution, pump revolutions and pressure.
- It is advisable to check the pump for leakage on a regular basis. Leaks of a few drops per minute are acceptable as long as a mixture of gear oil and water does not appear, e.g. when steam is diverted into the drive. Larger leaks can lead to a fall in pressure. This means the seals must be replaced on time.
- Leakage can occur if the pump has been idle for a long time or when starting with cold water. The leakage, however, should disappear nearly completely as soon as the seals become either moist or expand through warm water.
- The valves are also exposed to wear. The surfaces of the valve seat and valve plate wear due to the high valve frequency and water composition. Worn valves can be recognized by irregular flow and pressure.
- Apart from routine oil checks, the pump drive does not require any particular servicing. The radial shaft seals and plunger seals should be checked for oil leakage.

| Störungen | Ursachen | Abhilfen | Problem | Reasons | Remedies |
|---|---|---|---|---|---|
| Druck fällt ab. | Dachmanschetten undicht.<br>Überdrucksicherung strömt ab. | Dachmanschetten erneuern, Plunger reinigen. Einstellung der Überdrucksicherung prüfen. | Drop in pressure. | Leaky V-sleeves.<br>Water escapes from safety valve. | Replace V-sleeves, clean plungers.<br>Check adjustment of safety valve. |
| Druck fällt ab und Pumpe wird laut. Druck ist unregelmäßig. | Ventile verschlissen.<br>O-Ringe defekt. | Ventilteile prüfen und ggf. erneuern, O-Ring und Oberfläche im Gehäuse prüfen. | Pressure drops and pump becomes loud | Worn valves.<br>O-rings are defective. | Check valve parts and replace as necessary. Check O-ring, and surface in casing. |
| | Dampfbildung (Kavitation). | Wassertemperatur senken, Strömungswiderstand i.d. Saugleitung verringern, Saugfilter reinigen. | | Formation of steam (cavitation). | Reduce water temperature, reduce flow resistance in discharge line, clean suction filter. |
| | Schmutzfänger / Filter zugesetzt. | Filtereinsatz reinigen und auf Beschädigungen überprüfen. | | Strainer / Filter blocked. | Clean and check the filter insert for damage. |
| Überdrucksicherung bläst über "Bypass" ab. | Betriebsdruck zu hoch, falsche Einstellung der Überdrucksicherung. | Druckleitung blockiert oder verschmutzt. Überdrucksicherung neu justieren. | Pressure is released through the bypass valve. | Operating pressure is too high, safety valve is incorrectly adjusted. | Discharge line is blocked or soiled. Readjust safety valve. |
| Wasser nach kurzer Betriebszeit im Getriebeöl. | Dachmanschetten undicht.<br>Hohe Luftfeuchtigkeit. | Dachmanschetten erneuern, Prüfung auf Kavitation - Belüftung der Pumpe verbessern. | Water appears in gear oil shortly after starting. | Leaky V-sleeves.<br>High humidity. | Replace V-sleeves, check for cavitation - improve ventilation of pump. |
| Geräuschzunahme ohne Druckabfall. | Antriebslagerung verschlissen. | Antrieb zerlegen, Teile überprüfen, Ölzustand überprüfen. | Increase in noise without drop in pressure. | Worn drive bearings. | Dismantle gear, check parts, check condition of oil. |

# BETRIEBSANLEITUNG
# OPERATING INSTRUCTIONS

## SPECK-TRIPLEX-PLUNGERPUMPE
## SPECK-TRIPLEX-PLUNGER PUMP

## P51/135-90

### Leistungsbereich - Performance

| Type | Best.-Nr. | Leistungs-aufnahme | Überdruck max. | Drehzahl max. | Förder-menge max. | Wasser temp. max. | Plunger -Ø | Hub | Gewicht ca. | NPSHR |
|---|---|---|---|---|---|---|---|---|---|---|
| | Code No. | Power Consump. | Pressure max. | RPM max. | Output max. | Water-Temp. max. | Plunger dia. | Stroke | Weight approx. | NPSH Required |
| | | kW | bar | $min^{-1}$ | l/min | °C | mm | mm | kg | mWs |
| P51/135-90 | 00.5088 | 23,8 | 90 | 800 | 134,1 | 60 | 42 | 42 | 60,0 | 7,8 |

NPSH erf. ist gültig für Wasser (spez. Gewicht 1kg/$dm^3$, Viskosität =1°E) bei max. zulässiger Pumpendrehzahl.

### Inbetriebnahme und Wartung

Vor Inbetriebnahme Ölstand prüfen und für störungsfreien Wasserzulauf sorgen.

**Achtung!** Bei **Frostgefahr** muss das Wasser aus der Pumpe und den angrenzenden Anlagenteilen (insbesondere auch das UL-Ventil) entleert werden. Zum Entleeren kann der zweite, unbenutzte Druckanschluß verwendet werden. Hierzu kann die Pumpe ca. 1-2 Minuten „trocken" laufen.

Ölfüllmenge 3.0l. Nur Getriebeöl ISO VG 220 GL4 (z.B. Aral Degol BG220) oder KFZ- Getriebeöl SAE 90 GL4 verwenden.

Erster Ölwechsel nach 50 Betriebsstunden; dann alle 1000 Betriebsstunden, spätestens jedoch nach 1 Jahr. Achtung bei Betrieb in feuchten Räumen bzw. bei hohen Temperaturschwankungen. Bei Kondenswasserbildung im Getrieberaum (Aufschäumen des Öles) sofort Ölwechsel durchführen.

**NPSH-Wert beachten.**

Max. Zulaufdruck 6 bar, max. Saughöhe -0.3 bar. Darauf achten, dass die Saugpulsation ausreichend gedämpft wird – Resonanz der starren Wassersäule muss unbedingt vermieden werden.

### Sicherheitsvorschriften

Es ist ein Sicherheitsventil gemäß den "Richtlinien für Flüssigkeitsstrahler" vorzusehen, das so eingestellt ist, dass der Betriebsdruck um nicht mehr als 10% überschritten werden kann.

Bei Nichteinhaltung dieser Vorschrift sowie bei Überschreiten der Temperatur- und Drehzahlgrenze erlischt jegliche Gewährleistung.

Beim Betrieb der Pumpe muss das freie Wellenende durch den Wellenschutz (21), die angetriebene Wellenseite und Kupplung durch einen bauseitigen Berührungsschutz abgedeckt sein.

Zur Montage des Wellenschutzes am freien Wellenende der Kurbelwelle den Wellenschutz (21) zusammen mit dem Wellenschutzhalter (21A) mit den Lagerdeckelschrauben (17) am Lagerdeckel (14) befestigen

Vor Wartungsarbeiten an Pumpe und Anlage muss sichergestellt werden, dass Druckleitung und Pumpe drucklos sind! Saugleitung verschließen.

Versehentliches Starten des Antriebsmotors durch geeignete Maßnahmen vermeiden (Sicherungen herausschrauben).Vor Inbetriebnahme Pumpe und druckseitige Anlagenteile drucklos entlüften. Ansaugen und Fördern von Luft oder Luft-Wassergemisch sowie Kavitation unbedingt vermeiden.

**Kavitation bzw. Kompression von Gasen führt zu unkontrollierbaren Druckstössen und kann Pumpen- und Anlagenteile zerstören sowie Bedienungspersonal gefährden!**

SPECK-TRIPLEX-Pumpen sind geeignet zur Förderung von sauberem Wasser oder anderen nicht aggressiven oder abrassiven Medien mit ähnlichem spezifischen Gewicht wie Wasser.

**Werden andere Flüssigkeiten, insbesondere brennbare, explosive und toxische Medien gefördert, so ist eine Rücksprache mit dem Pumpenhersteller hinsichtlich der Materialbeständigkeiten unbedingt erforderlich. Die Einhaltung der entsprechenden Sicherheitsvorschriften ist durch den Gerätehersteller bzw. durch den Anwender sicherzustellen.**

Required NPSH refers to water: Spezific weight 1kg/$dm^3$, viscosity 1°E at max. permissible revolutions.

### Operation and Maintenance

Check oil level prior to starting and ensure trouble-free water supply.

**Important!** If there is a **danger of frost**, the water in the pump and in the pump fittings (particularly the unloader valve) must be emptied. The second discharge port can also be used and the pump run "dry" for 1-2 minutes for this purpose.

Oil: Use only 3.0 litres of ISO VG 220 GL4 (e.g. Aral Degol BG220) or SAE 90 GL4 gear oil.

Initial change after 50 operating hours and then every 1000 operating hours, or after 1 year if used less.

Caution when operating in damp places or with high temperature fluctuations. Oil must be changed immediately, should condensate (frothy oil) occur in the gear box.

**Keep NPSH under control.**

Max. input pressure 6 bar, max. suction head -0.3 bar. Make sure that suction pulsation is sufficiently dampened – water column resonance must be avoided.

### Safety Rules

Pump operation without safety valve as well as any excess in temperature or speed limits automatically voids the warranty. The safety valve must be regulated in accordance with the guidelines for liquid spraying units so that the admissible operating pressure can not be exceeded by more than 10%.When the pump is in operation, the open shaft end must be covered up by shaft protector (21), the driven shaft side and coupling by a contact-protector.

To cover the exposed crankshaft end, mount the shaft guard (21) together with the holder (21A) onto the bearing cover (14) and secure with bearing cover screws (17).

Pressure in discharge line and in pump must be at zero before any maintenance to the pump takes place. Close up suction line. Disconnect fuses to ensure that the driving motor does not get switched on accidently.

Make sure that all parts on the pressure side of the unit are vented and refilled, with pressure at zero, before starting the pump.

In order to prevent air, or an air/water-mixture being absorbed and to prevent cavitation occurring, the pump-npshr, positive suction head and water temperature must be kept under control.

**Cavitation and/or compression of gases lead to uncontrollable pressure-kicks which can ruin pump and unit parts and also be dangerous to the operator or anyone standing nearby.**

SPECK TRIPLEX Plunger Pumps are suitable for pumping clean water and other non-agressive or abrasive media with a specific weight similar to water.

**Before pumping other liquids - especially inflammable, explosive and toxic media - the pump manufacturer must under all circumstances be consulted with regard to the resistance of the pump material. It is the responsibility of the equipment manufacture and/or operator to ensure that all pertinent safety regulations are adhered to.**

# Instandsetzung

## Ventile überprüfen

Stopfen (48) herausschrauben. Darunter liegende Druck- bzw. Saugventile mit Flachzange oder Schraube M12 herausziehen (Schraube in Bohrung der Federspannschale eindrehen).
Mit Schraubendreher durch Aussparungen in der Federspannschale auf die Ventilplatte drücken und Ventil durch leichte Hebelbewegung zerlegen.
Teile überprüfen, verschlissene Teile ersetzen.
Stopfen (48) mit 145 Nm anziehen.

## Dichtungen und Plungerrohr überprüfen:

8xMutter (49A) lösen, Ventilgehäuse nach vorne abziehen. Dichtungen (40) aus Ventilgehäuse entnehmen; Dichtungshülsen aus den Führungen im Antriebsgehäuse ziehen und LRF-Dichtung (36) entnehmen.
Plungerrohre (29B) auf Beschädigungen prüfen; Verschmutzungen müssen entfernt werden. Bei Austausch von Plungerrohren (29B) neuen Cu-Dichtring (29D) verwenden und Spannschraube (29C) mit Schraubensicherungsmittel bestreichen und mit 45Nm anziehen.

**Achtung!** Schraubensicherungsmittel auf keinen Fall zwischen Plungerrohr (29B) und Zentrierhülse (29A) bringen. Verspannen des Plungerrohres durch exzentrisches Anziehen der Spannschraube bzw. durch Verschmutzung oder Beschädigung der Auflagefläche kann zum Bruch des Plungerrohres führen.

Dichtungen überprüfen und gegebenenfalls erneuern.
Neue, mit Öl bestrichene Dichtungen (40) mit Stützring (41) und Druckring (39) in Ventilgehäuse einlegen. Dichtungen (36) mit Druckring (36A) und O-Ring (36C) in Dichtungshülse (35) einsetzen, O-Ring (35A) überprüfen und gesamte Einheit in Ventilgehäuse montieren. Anschließend kompletten Pumpenkopf vorsichtig über die Plungerrohre fädeln und Muttern (49A) mit 80 Nm gleichmäßig anziehen.

## Getriebe zerlegen:

Nach Demontage von Ventilgehäuse und Plungerrohren Öl ablassen, Getriebedeckel (4) und Lagerdeckel (14) abschrauben.
Pleuelschrauben lösen und vordere Pleuelteile so weit wie möglich in Kreuzkopfführung vorschieben.

**Achtung!** Pleuel sind gekennzeichnet. Halbschalen nicht verdrehen. Pleuel beim Zusammenbau wieder in gleicher Position auf die Wellenzapfen der Kurbelwelle montieren.

Kurbelwelle unter leichtem Drehen mit Gummihammer nach einer Seite herausklopfen.

**Achtung!** Pleuelschäfte nicht verbiegen. Anschließend Laufflächen der Welle und der Pleuel sowie Wellendichtringe und Kegelrollenlager überprüfen.

## Zusammenbau:

Auf einer Lagerseite des Getriebes Lageraußenring mit weichem Werkzeug einpressen, bis dieser mit Außenkante der Lagerbohrung bündig ist.
Dann Lagerdeckel mit Wellendichtring und O-Ring aufschrauben. Welle durch gegenüberliegende Lagerbohrung einfädeln. Lageraußenring einpressen und mit Lagerdeckel nach innen spannen. Dabei Welle senkrecht halten und langsam durchdrehen, damit die Kegelrollen der Lager am Bund des Lageraußenringes anliegen.
Axiales Lagerspiel min. 0.1mm max. 0.15mm durch Beilegen von Paßscheiben (20A, 20B) unter einen Lagerdeckel einstellen.

**Achtung!** Welle soll nach Montage ohne spürbares axiales Spiel leicht drehbar sein. Anschließend Pleuelschrauben mit 30Nm anziehen.

# Maintenance

## To Check Valves

Screw off tension plugs (48). Take out discharge and suction valves underneath, either with flat tongs or an M12 screw, screwed into the hole of the spring tension disc, press onto valve plate and lever lightly to disassemble the valve.
Check and replace worn parts.
Tighten plug (48) to 145 Nm.

## To Check Seals and Plunger Pipe

Loosen the 8 nuts (49A) and take off valve casing frontwise. Remove seals (40) on valve casing. Take seal sleeve out of guide in crankcase and remove leakage seal (36).
Check plunger pipe (29B) for damage and remove any dirt. When replacing plunger pipes (29B) use new copper rings (29D), coat tension screw with glue and tighten it to 45Nm.

**Important!** Care must be taken that no glue gets between the plunger pipe (29B) and the centring sleeve (29A). The plunger pipe should not be strained by eccentric tightening of the tension screw or through damage to front surface of plunger, otherwise it will probably break.

Check seals and replace as necessary.
Place new oiled seals (40) along with support ring (39) in the valve casing. Place seals (36), pressure ring (36A) and O-ring (36C) in seal sleeve (35), check O-ring (35A) and install the complete unit in the valve casing. Finally, fit in the complete pump head assembly carefully over the plunger pipe and tighten nuts evenly to 80Nm.

## To Dismantle Gear

After removing valve casing and plunger pipe, drain oil. Screw off gear cover (4) and bearing cover (14).
Loosen con rod screws and push the front of the con rod forward as far as possible into the crosshead guide.

**Important!** Connecting rods are marked for identification. Do not twist con rod halves. Con rod is to be reinstalled in the same position on shaft journals.

Turning the crankshaft slightly, hit it out carefully to the side with a rubber hammer.

**Important!** Do not bend the con rod shanks. Check shaft and con rod surfaces, shaft seals and taper roller bearings.

## To Reassemble

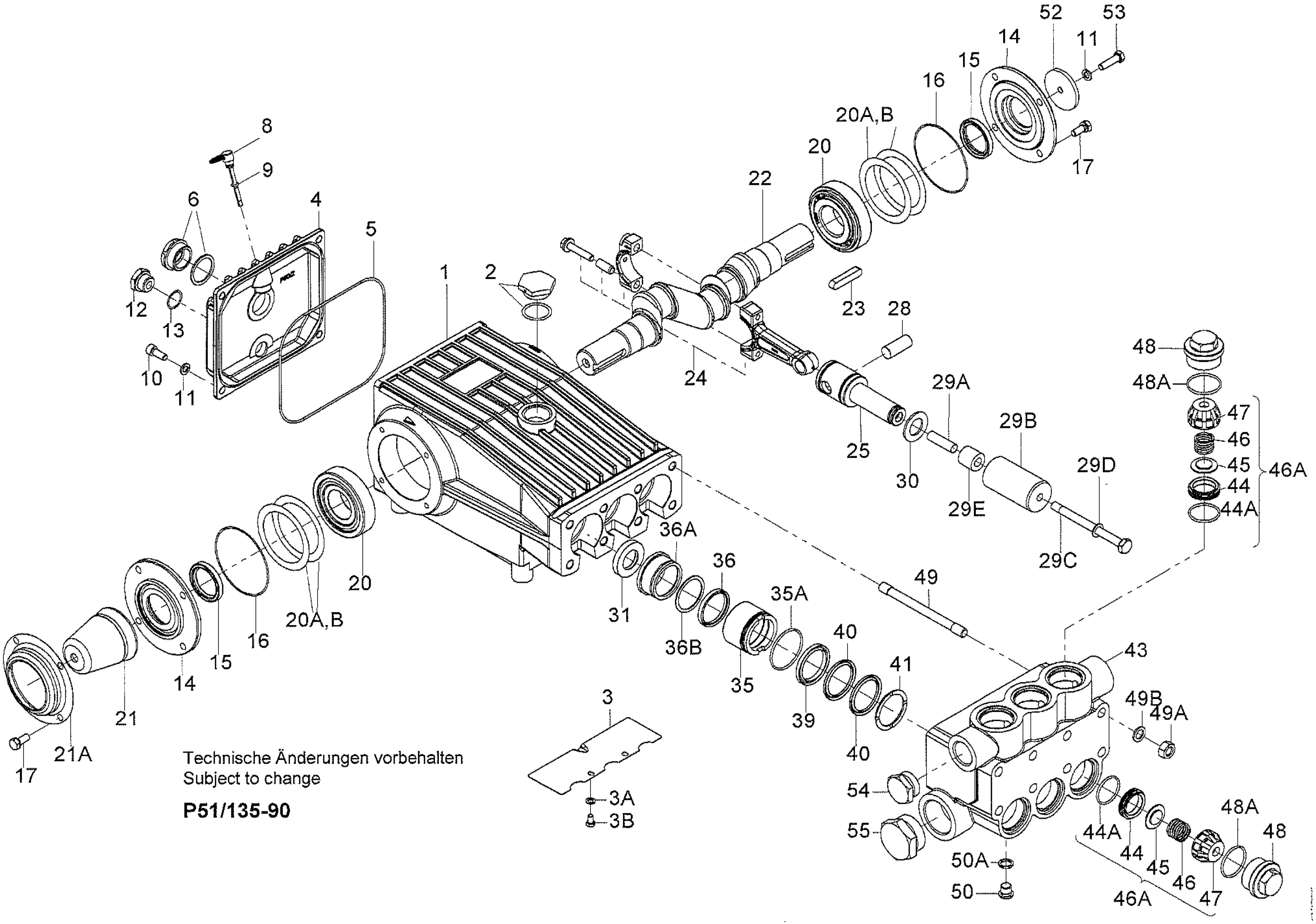
Using a soft tool, press in the outer bearing ring till the outer edge lines up with the outer edge of the bearing hole.
Screw off bearing cover together with shaft seal and O-ring. Fit shaft through bearing hole on the opposite side. Press in outer bearing and tension it inwards with the bearing cover, keeping the shaft in vertical position and turning slowly so that the taper rollers of the bearings touch the edge of the outer bearing ring.
Adjust axial bearing clearance to at least 0.1mm and maximum 0.15mm by placing fitting discs (20A, 20B) under the bearing cover.

**Important!** After assembly has been completed, the shaft should turn easily with very little clearance. Tighten con rod screws to 30NM.

## Ersatzteilverzeichnis P51/135-90 Best.-Nr.: 00.5088
## Spare Parts List Code Nr.

| Lfd. Nr. Item No. | Stückzahl No. Off | Best.-Nr. Code No. | Benennung | Description |
|---|---|---|---|---|
| 1 | 1 | 01.0608 | Antriebsgehäuse | Crankcase |
| 2 | 1 | 00.2914 | Ölauffüllstopfen kpl. | Oil Filler Plug Assy |
| 3 | 1 | 03.0364 | Abdeckblech | Cover Plate |
| 3A | 2 | 07.3052 | Federring | Spring Ring |
| 3B | 2 | 21.0290 | Sechskantschraube | Hexagon Screw |
| 4 | 1 | 03.0274 | Getriebedeckel | Crankcase Cover |
| 5 | 1 | 06.0103 | O-Ring zu 4 | O-Ring for 4 |
| 6 | 1 | 00.6049 | Ölschauglas kpl. | Oil Sight Glass Assy |
| 8 | 1 | 00.4502 | Ölmeßstab kpl. | Oil Dipstick Assy |
| 9 | 1 | 06.0053 | O-Ring zu 8 | O-Ring for 8 |
| 10 | 4 | 21.0026 | Zylinderschraube | Cylinder Screw |
| 11 | 5 | 07.2994 | Federring | Spring Ring |
| 12 | 1 | 07.0705 | Stopfen G1/2 | Plug G1/2 |
| 13 | 1 | 06.0067 | O-Ring zu 12 | O-Ring for 12 |
| 14 | 2 | 03.0137 | Lagerdeckel | Bearing Cover |
| 15 | 2 | 06.0101 | Radialwellendichtring | Radial Shaft Seal |
| 16 | 2 | 06.0104 | O-Ring zu14 | O-Ring for 14 |
| 17 | 8 | 21.0034 | Sechskantkombischraube | Hexagon Screw |
| 20 | 2 | 05.0096 | Kegelrollenlager | Taper Roller Bearing |
| 20A | 1-3 | 07.0789 | Paßscheibe | Fitting Disc |
| 20B | 1-3 | 07.2844 | Paßscheibe | Fitting Disc |
| 21 | 1 | 07.4563 | Wellenschutz | Shaft Protector |
| 21A | 1 | 07.4687 | Wellenschutzhalter | Shaft Guard Holder |
| 22 | 1 | 11.0657 | Kurbelwelle | Crankshaft |
| 23 | 1 | 07.3188 | Paßfeder | Fitting Key |
| 24 | 3 | 00.4391 | Gleitlagerpleuel kpl. | Connecting Rod Assy |
| 25 | 3 | 00.4392 | Kreuzkopf kpl. | Crosshead / Plunger Assy |
| 28 | 3 | 11.0659 | Kreuzkopfbolzen | Crosshead Pin |
| 29A | 3 | 07.2712 | Zentrierhülse | Centring Sleeve |
| 29B | 3 | 11.0560 | Plungerrohr | Plunger Pipe |
| 29C | 3 | 07.2714 | Spannschraube | Tensioning Screw |
| 29D | 3 | 06.0467 | Cu-Dichtring | Copper Ring |
| 29E | 3 | 07.3205 | Distanzrohr | Spacer Pipe |
| 30 | 3 | 07.3095 | Ölabstreifer | Oil Scraper |
| 31 | 3 | 06.0270 | Radialwellendichtring | Radial Shaft Seal |
| 35 | 3 | 07.3204 | Dichtungshülse | Seal Sleeve |
| •35A | 3 | 06.0105 | O-Ring | O-Ring |
| •36 | 3 | 06.1361 | Nutring | Grooved Ring |
| 36A | 3 | 07.4450 | Druckring | Pressure Ring |
| •36B | 3 | 07.4434 | Abstreifer | Scraper |
| 39 | 3 | 07.2141 | Druckring | Pressure Ring |
| •40 | 6 | 06.0725 | Dachmanschette | V-Sleeve |
| 41 | 3 | 07.2142 | Stützring | Support Ring |
| 43 | 1 | 01.0800 | Ventilgehäuse | Valve Casing |
| ••44 | 6 | 07.2679 | Ventilsitz | Valve Seat |
| ••44A | 6 | 06.0107 | O-Ring | O-Ring |
| ••45 | 6 | 07.2680 | Ventilplatte | Valve Plate |
| ••46 | 6 | 07.2758 | Ventilfeder | Valve Spring |
| ••47 | 6 | 07.2682 | Federspannschale | Spring Tension Cap |
| 48 | 6 | 07.3655 | Stopfen | Plug |
| ••48A | 6 | 06.0253 | O-Ring | O-Ring |
| 49 | 8 | 21.0273 | Stiftschraube | Stud Bolt |
| 49A | 8 | 07.0988 | Sechskantmutter | Hexagon Nut |
| 49B | 8 | 07.2707 | Scheibe | Disc |
| 50 | 1 | 07.1000 | Stopfen G1/4 | Stopfen G1/4 |
| 50A | 1 | 06.0108 | Cu-Dichtring | Copper Ring |
| 52 | 1 | 07.0796 | Scheibe für Kurbelwelle | Disc for Crankshaft |
| 53 | 1 | 21.0041 | Sechskantschraube | Hexagon Screw |
| 54 | 1 | 07.3160 | Verschlußstopfen G1 | Plug G1 |
| 55 | 1 | 07.3162 | Verschlußstopfen G1 1/2 | Plug G1 1/2 |
|  | 1 | 00.4622 | Antrieb kpl.<br>(1-29A/30/31/49/49A-B/52/53) | Crankcase Assy<br>(1-29A/30/31/49/49A-B/52/53) |
|  | 1 | 00.4572 | Plungerwechselsatz<br>(29B-E/35-41) | Plunger Replacement Kit<br>(29B-E/35- 41) |
|  | 1 | 00.5141 | Pumpenkopf kpl.<br>(43-48A/50/50A/54/55) | Pumphead Assy<br>(43-48A/50/50A/54/55) |
|  | 6 | 00.2412 | Ventil kpl. (44-47) | Valve Assy (44-47) |
| • | 1 | 14.0725 | Rep. Satz Dichtungen | Seal Repair Kit |
| •• | 1 | 14.0394 | Rep. Satz Ventile | Valve Repair Kit |

Bei Bestellung von Ersatzteilen bitte Bestell-Nr., Pumpen-Nr. und -type angeben.
When ordering please state Code No., Pump Model and Pump Serial No.



Technische Änderungen vorbehalten
Subject to change

**P51/135-90**

# Motor

## Beistellung vom Kunden
## ohne Dokumentation

## supplied by the customer
## without documentation

# Montage und Wartung des Riementriebes
# Assembly and Maintenance of the Belt-Drive

***Achtung!*** Aggregat niemals ohne ordnungsgemäß angebrachten Riemenschutz betreiben!

***Important!*** Never operate the unit without a correctly fitted belt guard!

## Nachspannen der Keilriemen

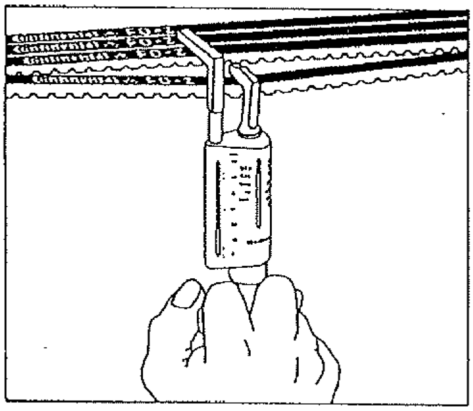
Bei neuen Keilriemen muss nach kurzer Einlaufzeit die Riemenspannung überprüft werden. Die korrekte Vorspannung wird durch verschieben der Pumpe erreicht.

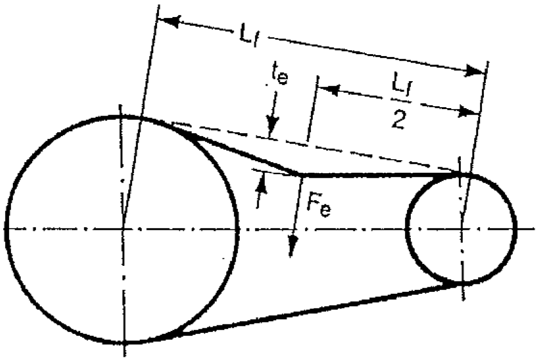
Bei einer Prüfkraft von $F_e$ und einer max. Eindrücktiefe $t_e$ ist die optimale Vorspannung gegeben. Eine überhöhte Vorspannkraft erhöht den Verschleiß und belastet die Wellenlager.

## Tensioning V-Belts

New V-belts must be checked for correct tensioning shortly after the run-in period. The correct tension is obtained by positioning the pump.

Optimal tensioning is achieved via a testing force of $F_e$ and a max. indentation of $t_e$.
Over-tensioning will increase wear and strain the shaft bearing.





$F_e =$ N
$t_e =$ mm

Die Einstellung der Keilriemen wird durch geeignete Vorspannungs-Messgeräte erleichtert, wie sie von Keilriemenlieferanten vertrieben werden.

Beim Erneuern der Keilriemen ist auf die korrekte Länge zu achten.
Bei mehrrilligen Antrieben muss immer der gesamte Riemensatz erneuert werden, da gebrauchte und neue Riemen unterschiedliche Dehnung aufweisen.

Die Riemen sollten ohne Gewalt aufgezogen werden. Hierzu die Pumpe soweit wie möglich zurückziehen, um den Achsabstand zu vermindern.

Adjustment of the V-belts is made easier by the use of special measuring instruments sold by the V- belt supplier.

Careful attention must be paid to the correct length when replacing V-belts.
All V-belts on multi-groove drive systems must be changed together as old and new belts do not have the same expansion properties.

Belts should be mounted without using force. To do this, the pump should be moved back as far as possible to reduce the centre-to-centre distance.

## Demontage und Montage der Riemenscheiben

Zum Lösen der Spannbuchsen die Madenschrauben entfernen. Eine der Madenschrauben in das vormals freie Gewindeloch einschrauben, bis sich die Buchse mitsamt der Scheibe von der Welle lösen läßt.

| Buchse | Schrauben-Anzugs Moment (Nm) | Schrauben | |
|---|---|---|---|
| | | Anzahl | Größe |
| 1008<br>1108 | 5.6 | 2 | 1/4"<br>BSW |
| 1310<br>1315 | 20 | 2 | 3/8"<br>BSW |
| 1210<br>1215 | 20 | 2 | 3/8"<br>BSW |
| 1610<br>1615 | 20 | 2 | 3/8"<br>BSW |
| 2012 | 31 | 2 | 7/16"<br>BSW |
| 2517 | 48 | 2 | 1/2"<br>BSW |
| 3020<br>3030 | 90 | 2 | 5/8"<br>BSW |
| 3535 | 112 | 3 | 1/2"<br>BSW |
| 4040 | 170 | 3 | 5/8"<br>BSW |
| 4545 | 192 | 3 | 3/4"<br>BSW |
| 5050 | 271 | 3 | 7/8"<br>BSW |

Bei der Montage der Scheiben auf einwandfreies Fluchten der Scheiben zueinander achten. Durch einen Versatz wird unnötiger Verschleiß erzeugt.

Zum Spannen der Spannbuchsen die beiden Madenschrauben seitlich der Dehnungsnut einschrauben bis die Buchse und somit die Scheibe einwandfrei festsitzt.

Auf Sauberkeit und Gratfreiheit der Riemenscheiben achten, auf Ausbrüche und Risse untersuchen und ggf. erneuern.

## Dismounting and Mounting Belt Pulleys

To take off the bushings, remove the grub (headless) screws. Screw one of the grub screws into the, up till now, vacant threaded hole until the bushing together with the pulley are loosened from the shaft.

| Bush | Screw Torque (Nm) | Screw | |
|---|---|---|---|
| | | Quantity | Size |
| 1008<br>1108 | 5.6 | 2 | 1/4"<br>BSW |
| 1310<br>1315 | 20 | 2 | 3/8"<br>BSW |
| 1210<br>1215 | 20 | 2 | 3/8"<br>BSW |
| 1610<br>1615 | 20 | 2 | 3/8"<br>BSW |
| 2012 | 31 | 2 | 7/16"<br>BSW |
| 2517 | 48 | 2 | 1/2"<br>BSW |
| 3020<br>3030 | 90 | 2 | 5/8"<br>BSW |
| 3535 | 112 | 3 | 1/2"<br>BSW |
| 4040 | 170 | 3 | 5/8"<br>BSW |
| 4545 | 192 | 3 | 3/4"<br>BSW |
| 5050 | 271 | 3 | 7/8"<br>BSW |

When remounting, the pulleys must be in perfect alignment with one another. Misalignment will cause unnecessary wear.

To tighten the bushings, screw in both grub screws to each side of the expansion groove until the bushing and pulley sit firmly. Make sure the V-belt pulleys are free of dirt.

Check for any metal chippings or fractures and replace the pulley/s if necessary.

**Continental**
**CONTITECH**

Power
Transmission Designer

V-belt calculation 29.04.2015 Version 7.2

| | | | |
|---|---|---|---|
| To | | From | |
| Company: | Riemenberechnung 600911Englisch | Company: | Speck-Kolbenpumpenfabrik |
| Fao: | | Responsible: | Martin Biedermann |
| Application: | | Telephone: | 08171/6293-0 |
| Remarks: | | Fax: | 08171/6293-97 |

---

Conti CONTI-V FO "DIN 7753" ADVANCE

| | | | | |
|---|---|---|---|---|
| Section | PROF | = | XPB | |
| Pitch diameter of small pulley | DWK | = | 160,00 | mm |
| Outside diameter of small pulley | DAK | = | 167,00 | mm |
| Pitch diameter of large pulley | DWG | = | 280,00 | mm |
| Outside diameter of large pulley | DAG | = | 287,00 | mm |
| Speed of small pulley | NK | = | 1475,00 | rpm |
| Speed of large pulley | NG | = | 842,86 | rpm |
| Transmission ratio | I | = | 1,75 | |
| Belt pitch length | LW | = | 1600,00 | mm |
| Belt inside length | LI | = | 1540,00 | mm |
| Centre distance | AER | = | 450,42 | mm |
| Arc of contact on the small pulley | BETA | = | 164,69 | grd |
| Positive centre adjustment for tensioning | X | + | 16,14 | mm |
| Negative centre adjustment for fitting | Y | - | 26,92 | mm |
| Belt speed | V | = | 12,36 | m/s |
| Belt flex frequency | FB | = | 15,45 | Hz |
| Power to be transmitted | P | = | 24,00 | kW |
| Torque on small pulley | MDK | = | 155,38 | Nm |
| Torque on large pulley | MDG | = | 271,91 | Nm |
| Given service factor | C2 | = | 1,20 | |
| Arc of contact factor | C1 | = | 0,96 | |
| Belt length correction factor | C3 | = | 0,87 | |
| Power rating per belt | PR | = | 15,53 | kW |
| Calculated number of V-belts | Zer | = | 2,21 | |
| Chosen number of V-belts | Z | = | 3 | |
| Calculated overall service factor | C2ER | = | 1,63 | |
| Min. pulley face width as per DIN | B2 | = | 63,00 | mm |
| Belt tension factor | K1 | = | 1,80 | |
| Effective pull | FU | = | 1942,23 | N |
| Static tension per belt | F | = | 610,43 | N |
| Total axle load | FV | = | 3629,92 | N |
| Dynamic axle load | FDYN | = | 3455,58 | N |
| Test force per belt | FE | = | 75,00 | N |
| Test deflection | TE | = | 11,64 | mm |
| Natural frequency of belt span | EIF | = | 63 | Hz |
| Service life | LH | > | 25000 | h |

---

**CONTI-V FO "DIN 7753" ADVANCE V-belt - 3 * XPB 1600,00 - LW**
**Small pulley P 3 - XPB - 160,00**
**Large pulley P 3 - XPB - 280,00**

---

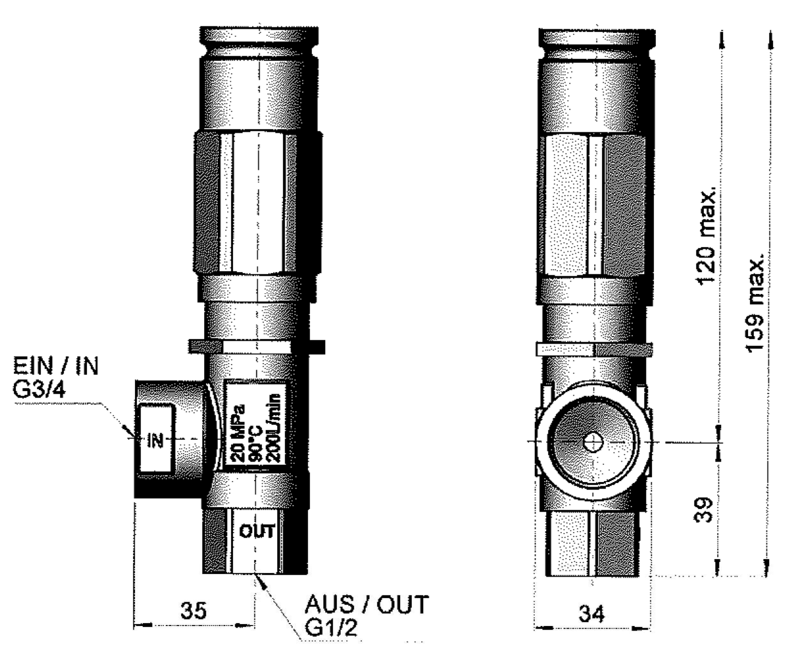
**All orders are subject exclusivley to our General Conditions of Business**

# TECHNISCHES DATENBLATT
# TECHNICAL DATA SHEET

SPECK

## ÜBERDRUCKSICHERUNG
## REGULATING VALVE

## VS200/180



## Leistungsbereich – Performance

| Type | Best.-Nr. | Durchfluss max. | Betriebsdruck. | Drucksteigerung |
|---|---|---|---|---|
| Type | Code No. | Flow Rate max. | Operating Pressure | Pressure Increase |
| | | l/min | bar | bar** |
| VS200/180 | 12.6700 | 200 | 180 | 15 |
| VS200/180 | 12.6700a* | 200 | 180 | 15 |

* Anschlüsse mit NPT-Gewinde

** Die Drucksteigerung ist die Druckzunahme, die benötigt wird, um die Gesamtdurchflussmenge zu entlasten, wenn das Ventil als Überdrucksicherung eingesetzt wird.

### Konstruktionsmerkmale

- Gehäuse und Anschlussteile aus Messing.
- Innenteile aus Edelstahl
- bewegte Teile komplett geschützt.
- Überdrucksicherungsventil pulsationsgedämpft.
- Bypassableitung bei minimalem Druckanstieg.
- Kann auch als Sicherheitsventil eingesetzt werden

### Als Sicherheitsventil

- Sichere und zuverlässige Entlastung der kompletten Durchflussmenge
- Promptes und effektives Dämpfen gefährlicher Druckspitzen

### Als Überdrucksicherung

- Sehr genauer Druckausgleich
- Kann bei Mehr-Lanzen-Betrieb eingesetzt werden

* NPT Connections

** Pressure increase is the rise in pressure necessary for the valve to discharge the max. flow when utilized as a pressure regulator.

### Construction Features

- Casing and fittings of brass.
- Internal parts of stainless steel
- Moving parts totally protected.
- Pressure regulating valve, compensated.
- Regulates the bypass of the liquid with minimum pressure variation.
- Suitable to be utilized as safety valve

### As safety valve

- Safe and reliable intervention, discharging all the flow.
- Prompt and effective damping action against dangerous pressure spikes

### As pressure regulator

- High balancing to guarantee the rated pressure when the flow varies in bypass
- Can be used with a multiple number of lances.

## AUSWAHL

Dieses Ventil ist für Frischwasser geeignet. Eine geringe Menge Reinigungsmittel kann dem Wasser zugeführt werden. Das Ventil ist gemäß den Leistungsnenndaten auszuwählen (Systemnenndruck, max. Durchflussmenge und max. Temperatur).

Der Maschinendruck darf nicht mehr als 10% über den Nenndruck steigen und niemals über den max. zulässigen Betriebsdruck.

Eine Düsengröße, die einen Bypass von mindestens 5% der kompletten Durchflussmenge erlaubt, ist einzusetzen. Beachten dass verschlissene Düsen zu Druckabfall führen.

Wenn das Ventil gemäß diesen Anweisungen montiert wird, werden Druckspitzen weitgehend vermieden.

## INSTALLATION

Bei Montage mit einem Dampfstrahlreiniger muss das Ventil vor dem Heizkessel eingebaut werden. Nur Armaturen verwenden, die auf die Leistung des Ventils abgestimmt sind.

Einsatz als SICHERHEITSVENTIL: Wenn das VS200/180 zusammen mit einem Unloaderventil verwendet wird, muss es nach dem UL-Ventil eingebaut werden.

Als ÜBERDRUCKSICHERUNG: Das VS 200/180 muss immer mit einem geeigneten Sicherheitsventil gekoppelt sein.

## BETRIEBSWEISE

Der Ventileingang ist seitlich angebracht, der Druckausgang liegt unterhalb der Messinghaube am gegenüberstehenden Ende.

Die Bypassleitung ist zu einem mit Leitblechen versehenen Behälter zurückzuführen. Falls die Pumpe direkt an der Wasserleitung angeschlossen ist, ist die Installation eines Druckreduktionsventils vor der Pumpe zu empfehlen, um gefährliche Druckspitzen zu vermeiden, die Rohre und Saugventile ernsthaft beschädigen könnten. Turbulenzen durch Bypasswasser am Pumpeneingang sind durch geeignete Maßnahmen zu vermeiden.

### DRUCKEINSTELLUNG

Als SICHERHEITSVENTIL muss das VS 200/180 so genau wie möglich auf den Systembetriebsdruck eingestellt werden. Diese Maßnahme verhindert unzulässige Druckanstiege in Dampfstrahlreinigern bei ausgeschalteter Pistole. Der eingestellte Druck soll hoch genug sein, um unerwünschte Aktivierung zu vermeiden.

Als ÜBERDRUCKSICHERUNG muss das VS 200/180 eingestellt werden, wenn das System unter Druck läuft und die Pistole geöffnet ist. Die Auswahl der passenden Düse sorgt für einen ruhigen Betrieb.

Der Druck wird durch Zudrehen des Handrades erhöht. Sollte der Druckaufbau enden, bevor der gewünschte Betriebsdruck erreicht wird, nicht versuchen den Druck noch weiter zu erhöhen, sondern Düsengröße kontrollieren, um sicherzustellen, dass sie auf die Durchflussmenge und Betriebsdruck abgestimmt ist.

Beim gewünschten Betriebdruck müssen 5% der Fördermenge durch den Bypass abströmen.

## SELECTION

This product is to be utilized with clean fresh water which can be slightly mixed with normal detergents. Choose the valve in line with the nominal operating data (system operating pressure, max. flow and max. temperature).

The operating pressure should not exceed more than 10% of the rated pressure, and must never exceed the permissible pressure.

Utilize a nozzle size that allows a bypass of at least 5% of the total flow.

Remember that a worn nozzle causes pressure loss. A correct fitting of the valve in line with these instructions will also ensure the avoidance of pressure spikes.

## INSTALLATION

When installed on steam cleaners, this accessory is to be assembled in front of the boiler. Make sure to utilize fittings which suit the valve dimensions and performance.

As SAFETY VALVE: if used together with an unloader valve, the VS200/180 must be installed downstream of the unloader valve.

As PRESSURE REGULATOR: the VS200/180 regulates the bypass of the liquid with a minimum variation of pressure. Always install coupled with an appropriate safety valve.

## OPERATION

The valve inlet is on the side, the discharge port is opposite the brass cap.

The bypass line should be returned to a baffled tank. If the pump is fed directly from the water mains, it is advisable to install a pressure reduction valve in front of the pump to avoid dangerous pressure spikes which could badly damage ducts and suction valves.

Turbulence caused by bypass water being fed back to the pump is to be avoided by installing an anti-turbulence device/s in front of the pump inlet.

### PRESSURE ADJUSTMENT

As SAFETY VALVE: adjust the pressure as close as possible to the system working pressure to thus prevent excess pressure increases on steam cleaners in the presence of static pressure (shut-off gun).

The set activation pressure should be large enough to avoid unwanted activation.

As PRESSURE REGULATOR: adjust the valve when the system is running under pressure and the is gun open. The operation will be easy and smooth if the proper nozzle is chosen. A rotation of the handle should correspond to a consequent increase of pressure: should the pressure stop increasing before reaching the desired value, do not insist but check the correct nozzle size in relation to the flow and pressure.

5% of the flow must run off through the bypass when the set operating pressure is fixed.

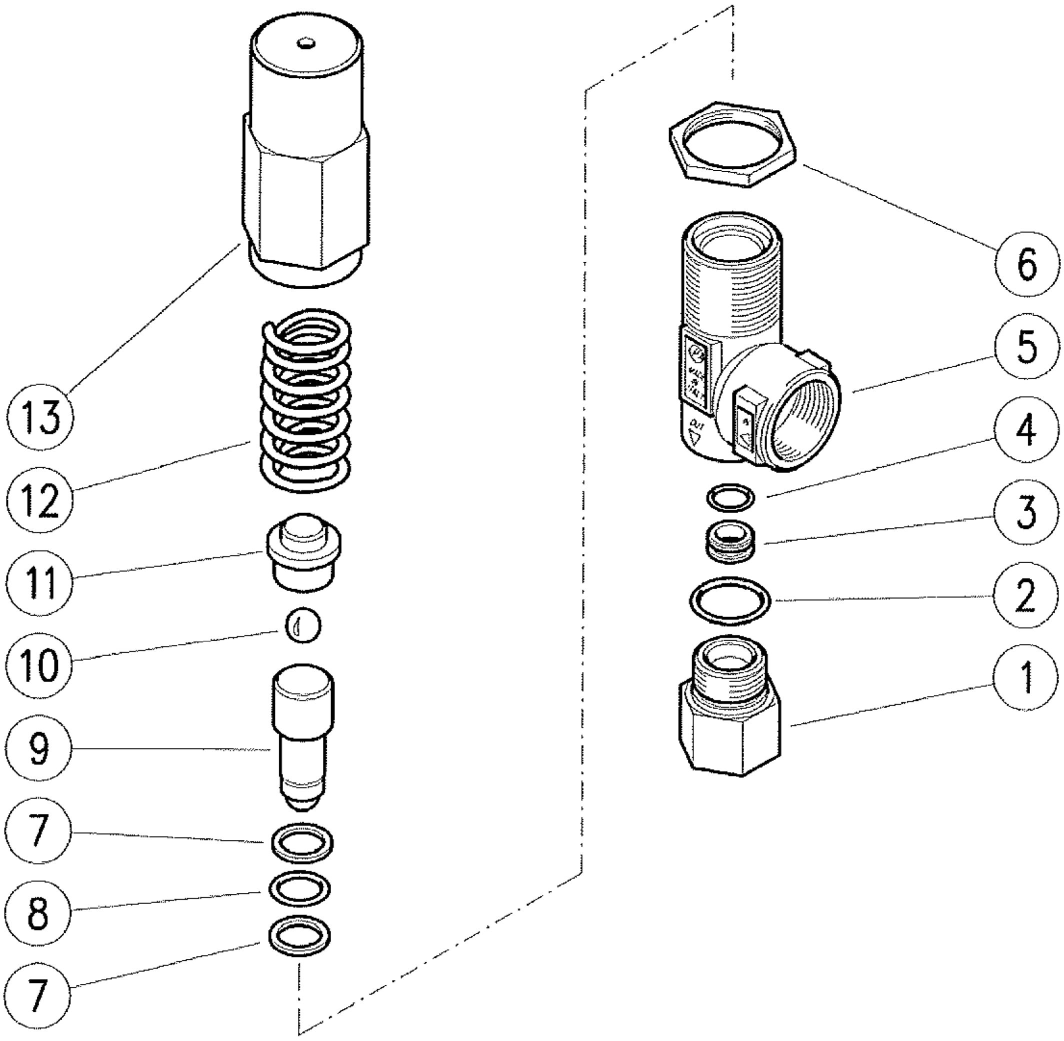
| Störungen | Ursache | Abhilfe |
|---|---|---|
| Ventil schaltet dauernd | Luft im System | entlüften |
| | verschlissene Dichtungen | ersetzen |
| | Schmutz | Schmutz entfernen |
| Ventil erreicht Betriebsdruck nicht | falsche Düsengröße | richtige Größe einsetzen |
| | Sitz verschlissen | ersetzen |
| | verschlissene oder beschädigte Düse | ersetzen |
| Druck fällt ab | Düse verschlissen | ersetzen |
| | Pumpendichtung verschlissen | ersetzten |
| | Ventilsitz verschlissen | ersetzen |
| | Luft im System | entlüften |
| Druckspitzen | Feder völlig zusammengedrückt | Feder lockern und Düsengröße ändern |
| | Düse verschmutzt | säubern |
| | Bypassströmung von min.5% der Gesamtdurchflussmenge nicht vorhanden | neu einstellen |
| Leckage am Druckausgang | Sitz für O-Ring beschädigt | ersetzen |
| | O-Ring beschädigt | ersetzen |

| PROBLEM | CAUSE | SOLUTION |
|---|---|---|
| Valve switches repeatedly | Air inside the system | Bleed |
| | Seals worn out | Replace |
| | Clogged circuit | Clean or widen passages |
| Valve does not come up to pressure | Nozzle not properly sized | Select a proper nozzle size |
| | Seat worn out | Replace |
| | Nozzle worn out or damaged | Replace |
| Pressure drops | Nozzle worn out | Replace |
| | Pump gaskets worn out | Replace |
| | Valve seat worn out | Replace |
| | Air inside the system | Bleed |
| Pressure spikes | Spring totally compressed | Loosen, and change nozzle size |
| | Clogged nozzle | Clean |
| | There is not a min.5% of total flow in bypass | Readjust |
| Water leaking at discharge | Seat o.ring damaged | Replace |
| | Seat damaged | Replace |

**SPECK - KOLBENPUMPENFABRIK**
Otto Speck GmbH & Co. KG · Postfach 1240 · D-82523 Geretsried
Tel. (08171) 62930 · Telefax (08171) 629399

## Ersatzteilverzeichnis VS200/180 (G) Best. Nr.: 12.6700
## Spare Parts List VS200/180 (NPT) Code No.: 12.6700a

| Lfd. Nr. Item No. | Stück No. Off | Best.-Nr. Code No. | Benennung | Description |
|---|---|---|---|---|
| 1 | 1 | 12.6701 | Anschlußstutzen G1/2 | Fitting G1/2 |
| 1 | 1 | 12.6710 | Anschlußstutzen NPT1/2 | Fitting NPT1/2 |
| •2 | 1 | 12.3030 | O-Ring | O-Ring |
| •3 | 1 | 12.6315 | Ventilsitz | Valve Seat |
| •4 | 1 | 12.1628 | O-Ring | O-Ring |
| 5 | 1 | 12.6702 | Gehäuse G3/4 | Casing G3/4 |
| 5 | 1 | 12.6711 | Gehäuse NPT3/4 | Casing NPT3/4 |
| 6 | 1 | 12.6703 | Kontermutter | Conternut |
| •7 | 2 | 12.6704 | Stützring | Support Ring |
| •8 | 1 | 12.1318 | O-Ring | O-Ring |
| •9 | 1 | 12.6705 | Kolbenkörper | Piston Body |
| 10 | 1 | 12.6314 | Kugel | Ball |
| 11 | 1 | 12.6706 | Federführung | Spring Guide |
| 12 | 1 | 12.6707 | Feder | Spring |
| 13 | 1 | 12.6708 | Stellmutter | Cap |
|  | • | 12.6709 | Rep. Satz | Repair Kit |



P.A. - S.p.A. - EQUIPAGGIAMENTI TECNICI DEL LAVAGGIO
VIA MILANO, 13 - CASELLA POSTALE 115 - 42048 RUBIERA (REGGIO EMILIA) - ITALY
Tel. +39 0522 623611 - Fax. +39 0522 629600 - R.E.A. RE 156319 - R. I. RE 11535 - Mecc. RE 013446
C.F. e P. IVA 01035950359 - Cap. Soc. i.v. € 750.000,00 - Codice Identificativo C.E.E. IT 01035950359
ART. 2497 - BIS C.C. DIREZIONE E COORDINAMENTO BENETTI srl R.I. TRIB. DI RE 01480690351
http://www.pa-etl.it - E-mail: info@pa-etl.it

# VS450-200/300 -Safety Valve

**Technical Handbook: E 256**

Compensated, pressure regulating valve.
It stabilizes fluid bypass with a minimized pressure variation.

DN 32

| | | | |
|---|---|---|---|
| **60.4120.00** | VS450 -200 | CE | 1"1/4 Bsp F |
| **60.4130.00** | VS450 -300 | | 1"1/4 Bsp F |
| **60.4120.50** | VS450 -200 | CE | 1"1/4 Npt F |
| **60.4130.50** | VS450 -300 | | 1"1/4 Npt F |

- Intended for use with high flow rates
- Special steel spring with superior mechanical features, to maintain calibration settings for longer
- Check valve specifically designed to prevent jammings
- Screw/Locknut adjustment to set maximum pressure level
- Dynamic seals with O-ring and sliding gasket
- Fixing screw slots

## TECNICAL DATA

Max. Flow Rate 450 l/min - Max. Temperature 90°C (1)

| P/N | RATED PRESSURE bar - MPa | PERMISSIBLE PRESSURE bar - MPa | MIN. ADJUSTABLE PRESSURE bar - MPa | (2) PRESSURE INCREASE bar - MPa | INLET | BYPASS | WEIGHT g |
|---|---|---|---|---|---|---|---|
| **60.4120.00** | 200 - 20 | 220 - 22 | 50 - 5 | 38 – 3.8 | 1"1/4 Bsp F | 1"1/4 Bsp F | 3800 |
| **60.4130.00** | 300 - 30 | 330 - 33 | 60 - 6 | 38 – 3.8 | 1"1/4 Bsp F | 1"1/4 Bsp F | 3800 |
| **60.4120.50** | 200 - 20 | 220 - 22 | 50 - 5 | 38 – 3.8 | 1"1/4 Npt F | 1"1/4 Npt F | 3800 |
| **60.4130.50** | 300 - 30 | 330 - 33 | 60 - 6 | 38 – 3.8 | 1"1/4 Npt F | 1"1/4 Npt F | 3800 |

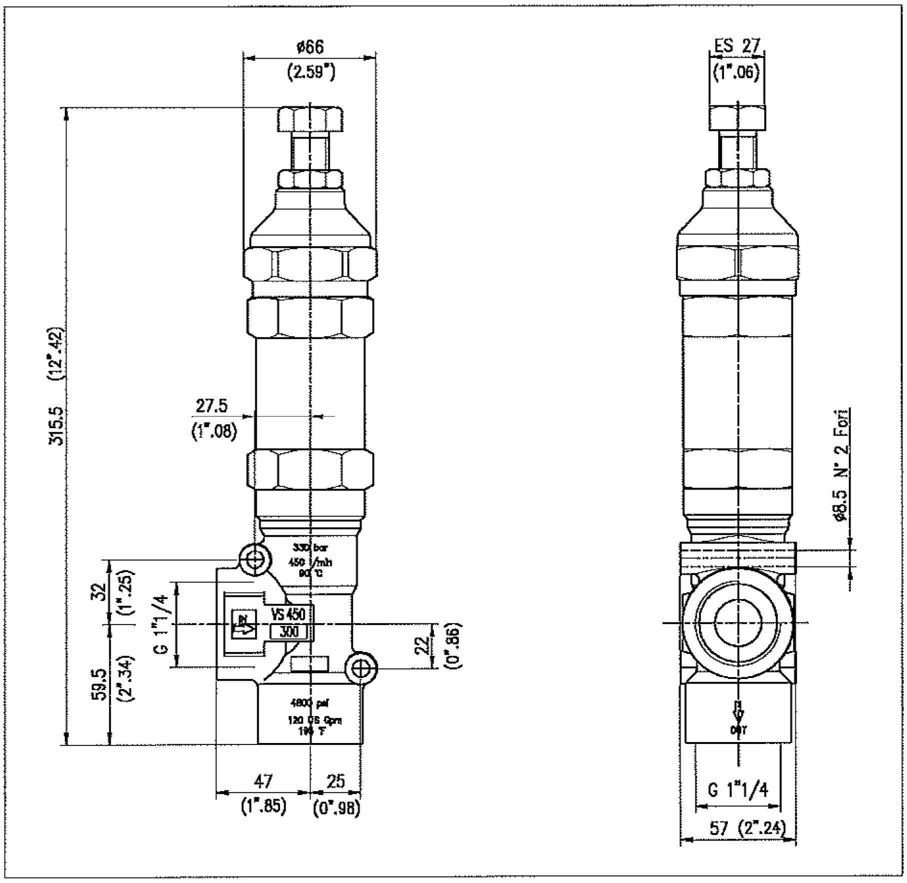
**(1)** The valve is especially designed for a constant use at a water temperature of 60℃. It can withstand up to a max. temperature of 90℃ for short intervals only.

**(2)** The max. pressure increase inside the valve occurs when the max. flow rate is discharged at max. calibration pressure.

| | |
|---|---|
| **Instruction, Maintenance, Installation, Spare Parts Booklet.**<br>For a correct use of the item, please follow the instructions.<br>**Please copy all relevant information on the use and maintenance booklet of the machine.** | n. 12.9256.00 |

Last Updated: 08/02/2012

## DIMNSIONAL DRAWING



## INSTRUCTIONS

### SELECTION

This product is to be used with clean, fresh water, or water slightly additivated with ordinary detergents. For use involving harsh or even corrosive fluids, always ask PA Technical Department first. Appropriate filtration should be installed when using unclean fluids.

To select the right valve, always take in consideration rated running data of the system (rated pressure, max. flow rate and max. temperature). In no case shall the system pressure exceed the **permissible pressure** marked on the valve.

### INSTALLATION

On a water heating machine, fit the valve before the **heat generator.** In the most frequent case of installation in combination with pressure regulating unloader valves, the safety valve shall be fitted after the unloader valve, on the side which remains in pressure after gun shut off.

### OPERATION

The valve regulates the max. system pressure through a piston, which acts on a cone that, normally positioned, closes the bypass opening.

The valve inlet is on the side, the discharge port is opposite to the adjustment screw (pos.15).

### PRESSURE SETTING/CALIBRATION

All pressure setting must be carried out in order that pressure calibration level is lower than the max. operating pressure rate of the system and its equipment. This is to prevent dramatic pressure increases occurring in water heating systems under static pressure conditions (i.e. when gun is not in operation).

**IMPORTANT: The nut (pos.14) must never be removed, as it is a mechanical safety device that limits the max pressure and prevents serious damage to persons and things.**

## DISCHARGE SYSTEM AND WATER ADDUCTION

The bypass conduct shall discharge outside of the machine or into a tank, but never directly into intake conduct. In case, it is advisable to install a baffled tank.

## PROBLEM HANDLING: CAUSES AND SOLUTIONS

| PROBLEMS | PROBABLE CAUSES | SOLUTIONS |
|---|---|---|
| Valve pulses | - Presence of air in the system<br>- Seals worn out<br>- Circuit blocked | - Bleed<br>- Replace<br>- Clean or widen up passages |
| Valve does not reach desired pressure level | - Wrong nozzle size<br>- Ball seat and/or shutter worn out<br>- Nozzle worn out<br>- Presence of material matter | - Change<br>- Replace<br>- Replace<br>- Clean |
| Pressure drops | - Nozzle worn out<br>- Pump seals worn out<br>- Valve seat worn out<br>- Presence of air in the system | - Replace<br>- Replace<br>- Replace<br>- Bleed |
| Pressure spikes | - Nozzle clogged | - Clean<br>- Repeat calibration procedure and replace nozzle |
| Water leaking out of discharge port<br>Valve chatters | - Seat O-ring worn out<br>- Seat worn out<br>- Presence of material matter<br>-Pump valves worn out | - Replace<br>- Replace<br>- Clean<br>- Replace |

### MAINTENANCE

In normal working conditions the safety valve should not open (no water discharge); if the valve is fitted on the pump head, it is in any case submitted to pressure cycles which have to be calculated for maintenance.

STANDARD: every 400 working hours (approximately 10000 working cycles of the system), check and lubricate the seals with water resistant grease.
SPECIAL: every 800 working hours (approximately 20000 working cycles of the system), control the wear of the seals and internal parts and, if necessary, replace with original PA parts taking care, during installation, to lubricate with water resistant grease.
Furthermore verify the absence of scale or dirt on the seat and the shutter.

**ATTENTION:** reassemble the valve in the correct manner paying special attention how to set the valve as described in the paragraph PRESSURE ADJUSTMENT/SETTING.

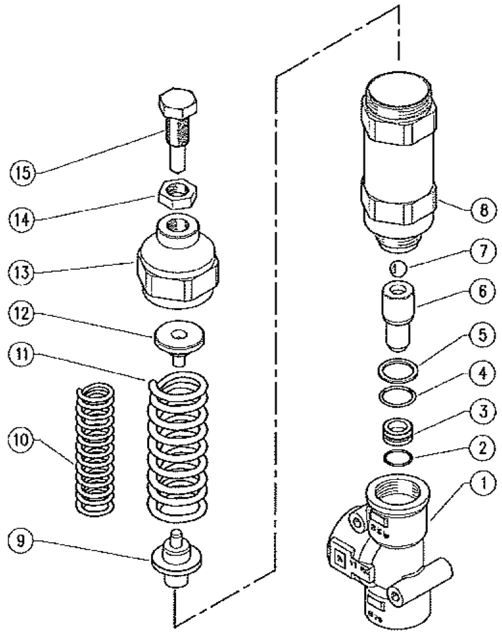
Maintenance has to be carried out by Specialized Technicians.

**The manufacturer is not to be considered responsible for damage as a result from incorrect fitting and maintenance**
Technical data, descriptions and illustrations are indicative and liable to modification without notice.

**REGULATIONS :** ***See Standard Manual.***
The equipment hereby described bears the CE marking in accordance with the Rules and Directives referred to in the ***Declaration of Conformity***.
For a correct use, follow the instructions given in this booklet and re-print them on the Use and Maintenace Booklet of the machine.
Make sure that you are given **the original Declaration of Conformity** for the chosen item. This booklet is **applicable for all valves type VS 450-200/300**

## 60.4120.00 VS450/200 safety valve 1"1/4F Bsp F
## 60.4120.50 VS450/200 unload. 1"1/4 Npt F

## 60.4130.00 VS450/300 unload. 1"1/4F Bsp F
## 60.4130.50 VS450/300 unload. 1"1/4 Npt F



| Pos. | P/N | Description | Q.ty | K1 | K2 | K3 | K4 | 🛒 |
|---|---|---|---|---|---|---|---|---|
| 1 | 60.4101.35 | Housing -VS450, 1"1/4 Bsp brass (1) | 1 | | | | | 1 |
| 1 | 60.4111.35 | Housing -VS450, 1"1/4 Npt F brass (2) | 1 | | | | | 1 |
| 2 | 10.3072.01 | O-ring, 1,78x20,35 mm NI 85 | 1 | • | | | | 10 |
| 3 | 60.4109.51 | Seat, 15x23,5x10 mm Sst. | 1 | • | | | | 3 |
| 4 | 10.3244.00 | O-ring, 3,53x24,99 mm | 1 | • | | | | 10 |
| 5 | 10.4097.00 | Back-up ring, 25x31,2x2mm | 1 | • | | | | 5 |
| 6 | 60.4108.51 | Piston -VS450, Sst. | 1 | • | | | | 3 |
| 7 | 14.7465.00 | Ball, 1/2" Sst. | 1 | | | | | 5 |
| 8 | 60.4106.31 | Piston holder, M 36 | 1 | | | | | 1 |
| 9 | 60.4103.31 | Ball holder | 1 | | | | | 3 |
| 10 | 60.4110.61 | Spring, 5,5x15,5x94mm (1) | 1 | | | | | 3 |
| 11 | 60.4102.61 | Spring, 10,5x33,5x119mm | 1 | | | | | 3 |
| 12 | 60.4105.31 | Spring guide | 1 | | | | | 3 |
| 13 | 60.4104.31 | Plug, M 52 brass | 1 | | | | | 3 |
| 14 | 11.4850.08 | Nut, M 18 Sst. | 1 | | | | | 3 |
| 15 | 60.4107.51 | Screw, M18 Sst. | 1 | | | | | 5 |

| Kit | P/N | Description | 🛒 |
|---|---|---|---|
| K1 | 60.4122.24 | Spares kit -VS 450/200-300, 5x1pcs. | 1 |

(1) 60.4130.00 (2) 60.4130.50

END ARMATUREN

*Qualität von Anfang an.*

## Technische Daten

**BAUFORM**
2-teilige kompakte Körperkonstruktion. Mit Abschließvorrichtung am Handhebel.

**BETÄTIGUNG**
90°-Drehung des Handhebels

**ANSCHLUSS**
Innengewinde nach DIN 2999:
¼" - 3"

**BETRIEBSDRUCK**
Grobvakuum bis Nenndruck (bis +80°C):
Bei Betriebstemperaturen über +80°C siehe Druck-Temperatur-Diagramm.

**TEMPERATUR**
-20°C bis max. +180°C

**WERKSTOFFE**

| | |
|---|---|
| Gehäuse: | Edelstahl 1.4408 |
| Kugel: | Edelstahl 1.4408 |
| Kugeldichtung: | PTFE |
| Spindeldichtung: | PTFE |
| Handhebel: | Edelstahl 1.4301<br>Kunststoff ummantelt |

**BESONDERHEITEN**
Der Kugelhahn besitzt eine Abschließvorrichtung am Handhebel.

Alle Angaben sind freibleibend und unverbindlich!

## Specification

**DESIGN**
2-piece designed ball valve.
With locking device.

**OPERATION**
Rotation of the handle through 90°.

**CONNECTION**
Threaded connection acc. to DIN 2999:
¼" - 3"

**PRESSURE RANGE**
Almost vacuum up to nominal pressure (max. +80°C). For higher temperatures please refer to the Pressure- Temperature-Diagram.

**TEMPERATURE RANGE**
-20°C up to +180°C

**MATERIALS**

| | |
|---|---|
| Body: | Stainless steel 1.4408 |
| Ball: | Stainless steel 1.4408 |
| Ball seal: | PTFE glassfiber reinforced |
| Spindle seal: | PTFE |
| Handle: | Stainless steel 1.4301<br>plastic coated |

**CHARACTERISTICS**
Ball valve with locked device handle.

The above information is intended for guidance only and the company reserves the right to change any data herein without prior notice!

Artikel:
**ZM**

2-Wege Kugelhahn
PN130 / PN100

Edelstahl

Type:
**ZM**

2-way Ball valve
PN130 / PN100

Stainless steel

## Artikel- u. Bestellangaben: z.B. ZM311023 =

2-Wege Kugelhahn, Edelstahl, handbetätigt, Gewinde ½"

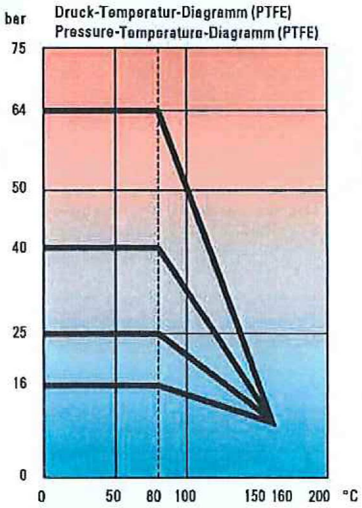
| **1. + 2. Stelle** Produkt | **3. + 4. Stelle** Werkstoffe Gehäuse / Dichtung / Kugel | **5. Stelle** Betätigung | **6. Stelle** Optionen | **7. + 8. Stelle** Anschluß |
|---|---|---|---|---|
| **ZM** =<br>2-Wege Kugelhahn | **31** = Edelstahl / PTFE / Edelstahl | **1** = Handhebel | **0** = ohne | **21** = ¼ |
| | | | | **22** = ⅜ |
| | | | | **23** = ½ |
| | | | | **24** = ¾ |
| | | | | **25** = 1 |
| | | | | **26** = 1¼ |
| | | | | **27** = 1½ |
| | | | | **28** = 2 |
| | | | | **29** = 3 |

## Ordering example: e.g. ZM311023 =

2-way Ball valve, Stainless steel, Handle, threaded connection ½"

| **1. + 2. Digit** Product | **3. + 4. Digit** Materials Body / seals / ball | **5. Digit** Operation | **6. Digit** Options | **7. + 8. Digit** Connection |
|---|---|---|---|---|
| **ZM** =<br>2-way Ball valve | **31** = Stainless steel / PTFE / Stainless steel | **1** = Handle | **0** = ohne | **21** = ¼ |
| | | | | **22** = ⅜ |
| | | | | **23** = ½ |
| | | | | **24** = ¾ |
| | | | | **25** = 1 |
| | | | | **26** = 1¼ |
| | | | | **27** = 1½ |
| | | | | **28** = 2 |
| | | | | **29** = 3 |

## Druck - Temperatur - Diagramm / Pressure - Temperature - Diagram



## EU-Herstellererklärung / EU-Declaration by the manufacturer

im Sinne der EU-Maschinenrichtlinie 98/37/EG (früher 89/392/EWG, Anhang II B)
Hiermit erklären wir, dass die Kugelhähne unter Anwendung nachfolgender harmonisierter Normen entwickelt und konstruiert wurden:

| | |
|---|---|
| EN 292 | Sicherheit von Maschinen |
| EN 983 | Fluidtechnische Anlagen - Pneumatik |
| EN 60204-1 | Elektrische Ausrüstung von Maschinen |

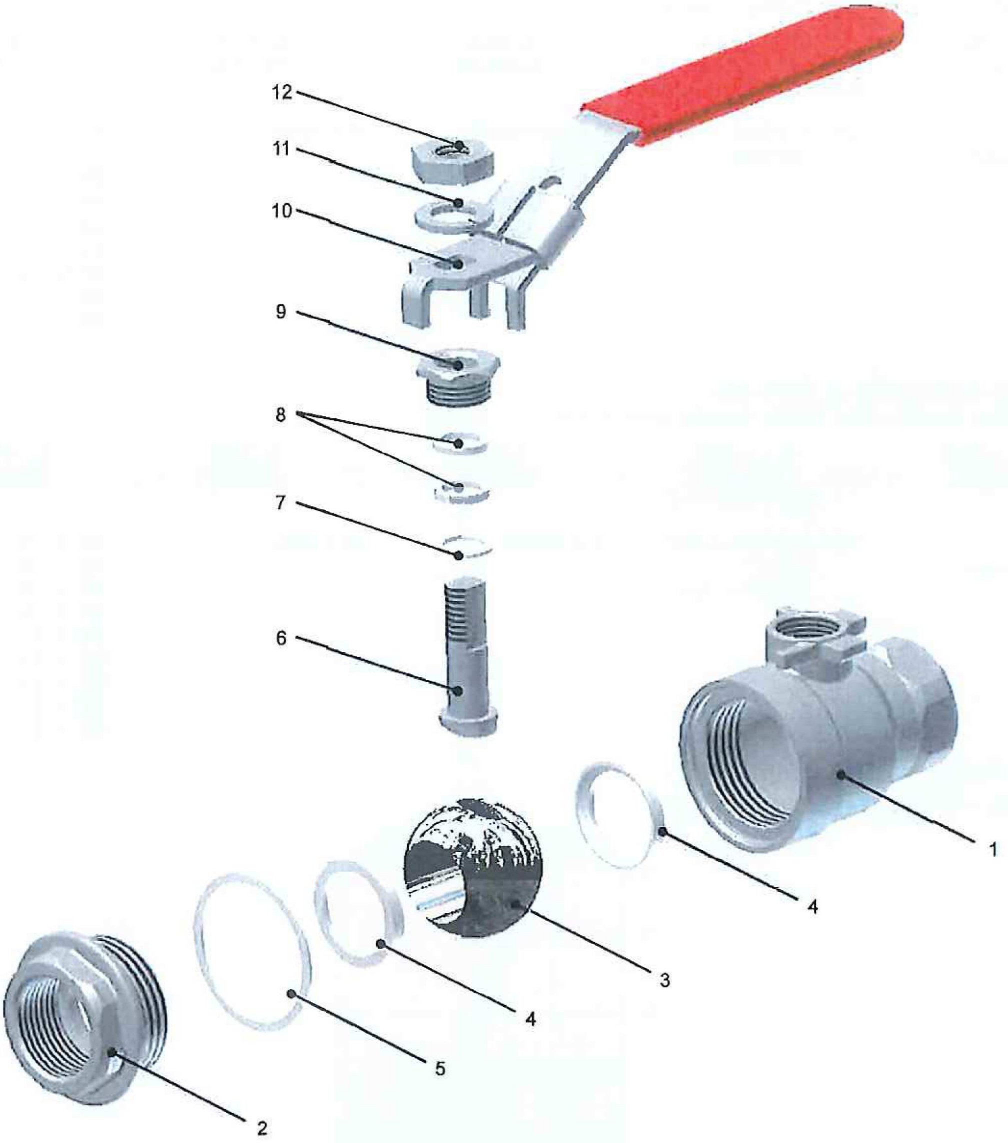
**Hinweis**
Die Kugelhähne sind zum Einbau in eine Maschine bestimmt. Deren Inbetriebnahme ist solange untersagt, bis festgestellt wurde, dass die Gesamtmaschine der EU-Richtlinie entspricht.

as defined by Machinery Directive 98/37/EC (former 89/392/EEC, Annex II B),
we herewith declare that the ball valves have been developed and designed by applying the following harmonised standards:

| | |
|---|---|
| EN 292 | Safety of machinery |
| EN 983 | Safety requirements for fluid power systems and components - Pneumatics |
| EN 60204-1 | Electrical equipment of machinery |

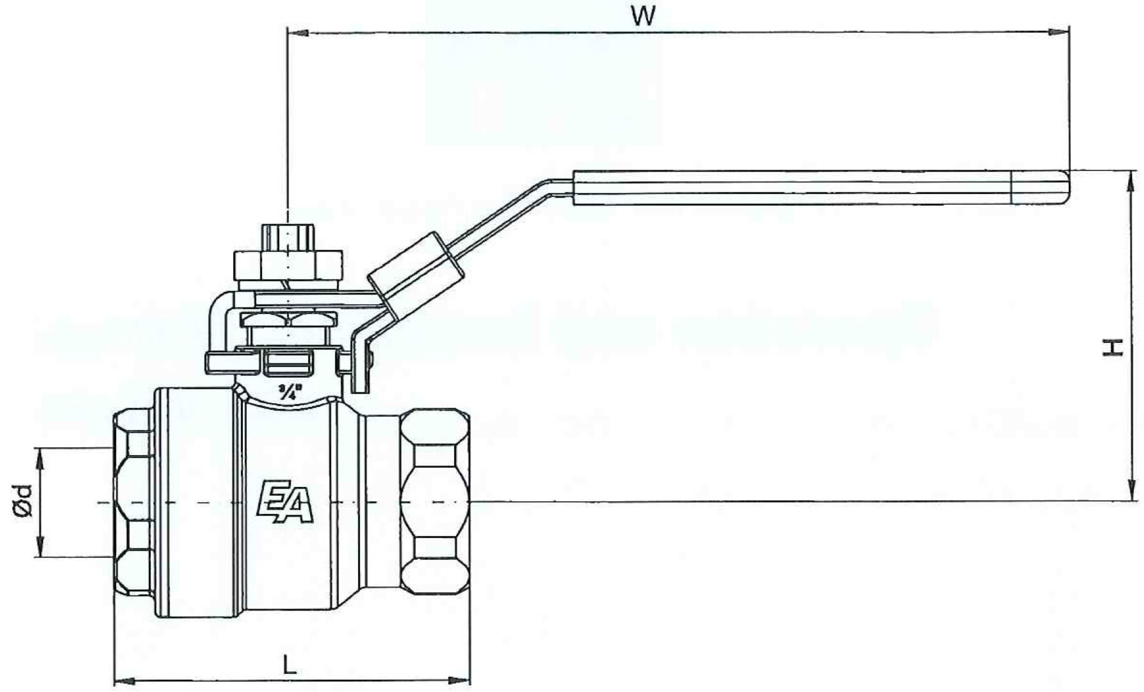
**Advice**
These ball valves are intended to be incorporated into machinery compounds. Putting into operation of the machinery is not allowed until such time as the entire machinery is proving to comply completely with the EU Directive.

## Stückliste / Parts list



| Pos. | Bezeichnung / Desciption | | Material / Material | |
|---|---|---|---|---|
| 1 | Gehäuse | body | Edelstahl 1.4408 | Stainless steel AISI 316 |
| 2 | Verschluß | cap | Edelstahl 1.4408 | Stainless steel AISI 316 |
| 3 | Kugel | ball | Edelstahl 1.4408 | Stainless steel AISI 316 |
| 4 | Sitzdichtung | seats | PTFE - glasfaserverstärkt | PTFE - glassfiber reinforced |
| 5 | Gehäusedichtung | gasket | PTFE | PTFE |
| 6 | Spindel | stem | Edelstahl 1.4408 | Stainless steel AISI 316 |
| 7 | Spindeldichtung | stem seal | PTFE | PTFE |
| 8 | Dichtungspackung | packing | PTFE | PTFE |
| 8 | Dichtungs-Mutter | packing gland | Edelstahl 1.4301 | Stainless steel 304 |
| 10 | Handhebel mit | handle with | | |
| | Verschlussvorrichtung (14) | locking device (14) | Edelstahl 1.4301 | Stainless steel 304 |
| 11 | Unterlegscheibe | washer | Edelstahl 1.4301 | Stainless steel 304 |
| 12 | Mutter | nut | Edelstahl 1.4301 | Stainless steel 304 |

## Abmessungen /
## Dimensions

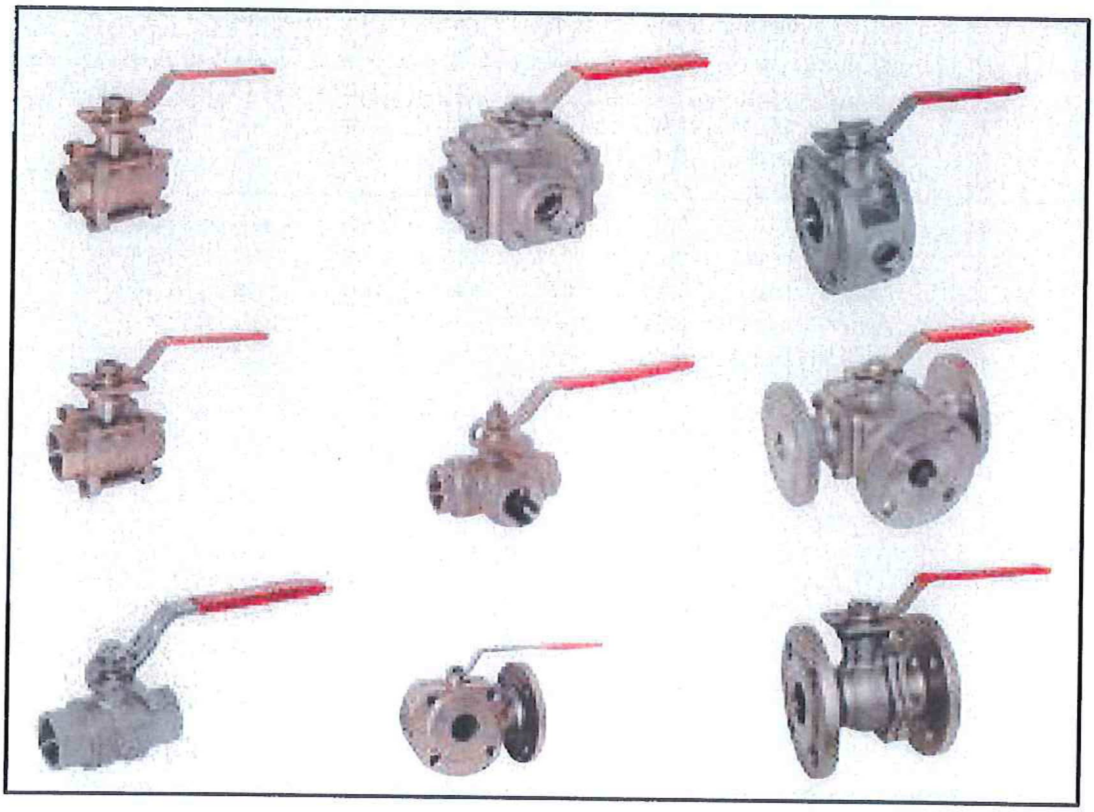


| DN | G | Ød | L | H | W | m | Kv-Wert |
|---|---|---|---|---|---|---|---|
| | | [mm] | [mm] | [mm] | [mm] | [kg] | [m³/h] |
| 8 | ¼" | 11,6 | 47,0 | 51,0 | 95 | 0,19 | 5,5 |
| 10 | ⅜" | 12,7 | 47,0 | 51,0 | 95 | 0,18 | 6,5 |
| 15 | ½" | 15,0 | 58,0 | 53,0 | 95 | 0,25 | 9,3 |
| 20 | ¾" | 20,0 | 66,0 | 59,5 | 110 | 0,40 | 17,5 |
| 25 | 1" | 25,0 | 77,0 | 73,0 | 135 | 0,67 | 23,3 |
| 32 | 1¼" | 32,0 | 90,0 | 79,0 | 135 | 1,05 | 47,5 |
| 40 | 1½" | 38,0 | 102,0 | 90,5 | 165 | 1,67 | 66,5 |
| 50 | 2" | 50,0 | 123,0 | 98,5 | 165 | 2,79 | 123,0 |
| 65 | 2½" | 65,0 | 156,0 | 130,5 | 215 | | 220,5 |
| 80 | 3" | 80,0 | 184,0 | 142,0 | 215 | | 345,5 |

EA
END ARMATUREN

*Qualität von Anfang an.*

# Operation and Installation Manual
# Ball Valves



END-Armaturen GmbH & Co. KG
Postfach (PLZ 32503) 100 341 · Oberbeckener Str. 76 · D-32547 Bad Oeynhausen · Telefon (05731) 7900-0 · Telefax (05731) 7900-199 · http://www.end.de

# Impressum

**© by END-Armaturen GmbH & Co. KG**

All rights reserved. END-Armaturen GmbH & Co. KG claims copyright over this documentation.
This documentation may neither be altered, expanded , reproduced nor passed to third parties without the written agreement of END-Armaturen GmbH & Co. KG . This restriction also applies to the corresponding drawings.
END-Armaturen GmbH & Co. KG has the right or change parts of the valves and armatures at any time without prior or direct notice to the client. The contents of this publication are subject to change without notice.

This publication has been written with great care. However, END-Armaturen GmbH & Co.KG cannot be held responsible, either for any errors occuring in this publication or for their consequences.

The products are specified by the statements in this documentation; no assurance or the properties is given.

**END-Armaturen GmbH & Co. KG**
Oberbecksener Straße 78
D-32547 Bad Oeynhausen
Telefon: 05731 / 7900 - 0
Telefax: 05731 / 7900 - 199
Internet: http://www.end.de
E-Mail: post@end.de

Edition: 01/2012

## Contents

**1 Foreword 4**

**2 General advice 5**
2.1 Validity 5
2.2 Inward monitoring 5
2.3 Complaints 5
2.4 Guarantee 5
2.5 Symbols and their signification 6

**3 Safety advice 7**
3.1 Personal advice 7
3.1.1 Safety advices for mounting 7
3.1.2 Safety advice for adjustment / starting 7
3.1.3 Safety advice for maintaining / repairing 8
3.2 Device safety 9

**4 Name-plate 10**

**5 Ball valves 11**
5.1 General 11
5.2 Corresponding use 11
5.3 Operation 11
5.4 Mounting / Disassembly 11
5.4.1 Mounting with threaded connection 12
5.4.2 Mounting with welded connection 13
5.4.2.1 Disassembly of the center part of the ball valve 13
5.4.2.2 Welding of the connection ends 14
5.4.2.3 Mounting of the center part 15
5.4.3 Mounting with flanged connection 16
5.5 Maintenance 17
5.5.1 Readjusting of the gland 18
5.5.2 Exchange of the ball and the sealing 19
5.5.2.1 3-part ball valve with threaded or welded connection 19
5.5.2.2 Multiple part ball valve with flanged connection 22

**6 Declaration in conformity as defined by Pressure-Equipment-Directive 97/23/EC 26**

## 1 Foreword

Dear customer,
Dear assembler / user,

these operation and installation manuals are intended to give you the knowledge, which is necessary for you to be able to carry out the mounting and adjustment of the ball valves rapaidly and correctly.

Please read these instructions carefully and pay particular attention to the advice and warning notes.

Only instructed and qualified mechanician should mount, adjust or maintain the ball valves.

If you have any questions in relation to the ball valves we shall be pleased to answer them.
The telephone number will be found on the inside cover of these operation and installation manual.

Yours
**END-Armaturen GmbH & Co. KG**

# 2 General advice

## 2.1 Validity

These mounting and installation manual is valid for the standard version of the ball valves.

## 2.2 Inward monitoring

Please check

- directly after delivery the ball valves for any transport damages and deficiencies.
- with reference to the accompanying delivery note the number of parts.

Do not leave any parts in the package.

## 2.3 Complaints

Claims for replacement or goods which relate to transport damage can only be considered valid if the delivery company is notified without delay.

In case of returns (because of transport damage / repairs), please make a damage protocol and send the parts back to the manufacturer, if possible in the original packaging.

In case of a return, please mention the following:

- Name and address of the consignee
- Stock-/ ordering-/ article-number
- Description of the defect

## 2.4 Warranty

For our ball valves we give a guarantee period in accordance with the sales contract.
The end of the normal duration of life of the wearing parts represents no defect.

The warranty and guarantee rules of **END-Armaturen GmbH & Co. KG** are applicable.

## 2.5 Symbols and their signification

Paragraphs which are identified with this symbol contain very important advices; this also includes advices for averting health risks. Observe these paragraphs without fail!

Paragraphs which are identified with this symbol contain very important advices, this also includes how to avoid damage to property. Observe these papgraphs without fail!

This symbol indicates paragraphs which contain comments / advices or tips.

This spanner identifies the description of actions which you should carry out.

# 3 Safety advice

Depending on the technical circumstances and the time under and at which the armatures and valves are mounted, adjusted and commissioned, you must take into account particular safety aspects in each case!

If, for example, a pneumatic actuator works a slide in an operational chemical plant, the potential hazards of commissioning have another dimension from that when this is only being carried out for test purposes an a „dry" part of the plant in the assembly room!

Since we do not know the circumstances at the time of the mounting/adjustment/commissioning, you may find advices on hazards in the following descriptions which are not relevant to you.

Please observe (only) the advices which applies to your situation!

## 3.1 Personal advice

### 3.1.1 Safety advices for mounting

**We wish to point out expressly that the mounting, adjusting and at accessories the pneumatical and eletrical installation of the armatures and valves must be carried out by trained specialist personnel having mechanical, pneumatical and electrical knowledge!**

**Secure that the machine / plant come up to the Machinery Directice after the mounting and installing of the armatures and valves.**

**Switch off all the devices / machines / plant affected by mounting or repair.**
**If appropriate, isolate the devices / machines / plant from the mains.**

**Check (for example in chemical plants) whether the switching off of devices / machines / plant will cause potential danger.**

**If appropriate, in the event of a fault in the armature / valve (in a plant which is in operation) inform the shift forman / safety engineer or the works manager without delay about the fault, in order, for example, to avoid an outflow / overflow of chemicals or the discharge of gases in good time by means of suitable measures!**

**Before mounting or repairing, remove the pressure from pneumatic / hydraulic devices / machines / plant.**

**If necessary, set up warning signs in order to prevent the inadvertent starting up of the devices / machines / plant.**

**Observe the respective relevant professional safety and accident prevention regulations when carrying out the mounting / repair work.**

**Check the correct functioning of the safety equipment (for example the emergency push off buttons/ safety valves, etc)!**

### 3.1.2 Safety advice for adjustment / starting

**As a result of the starting (pneumactic, electric or by hand) of the armatures and valves the flow of gases, steam, liquids, etc. may be enabled or interrupted!** Satisfy yourself that, as a result of the starting or the test adjustment no potential hazards will be produced for the personnel or the environment!

**If necessary, set up warning signs in order to prevent the inadvertent starting up or shutting down of the device / machine / plant.!**

**By ending the adjustment check the correct function and should the occasion arise the position of the slide / valve / flap.**

**Check the function of the limit switches (option)!**

**Check, whether the slide / valve / flap will be closed totally, if the control signals the appropriate limit stop!**

**Through suitable measures, prevent links being trapped by moving actuating elements!**

**Check the right function of all safety devices (for example emergency push off buttons / safety valves)!**

**Carry out the starting and the adjustments only in accordance with the instructions discribed in this documentation!**

**Adjusting switch on armatures and valves with options (e.g. actuators, solenoid valves, limit switches) there is the risk that live parts (230 V AC~) can be touched!**
**Therefore the adjustments must be carried out only by the electrican or a person having adequate training, who is aware of the potntial hazard!**

### 3.1.3 Safety advice for maintaining / repairing

**Do not carry out any maintenances / repairs if the armature / valve will be under pressure.**

Before disassembling or a armature or valve some essential points should be clarified!
- Will the armature/valve to be disassembled be replaced by another immediately?
- If appropriate, does the production process of the plant needed to be stopped?
- Is it necessary to inform specific personnel about the disassmbly?

**If necessary, inform the shift foreman/ safety engineer or the manager about the maintenance or repair without delay in order, for example, to avoid an outflow/ overflow of chemicals or a discharge of gases in good time by means of suitable measures!**

**Observe that some valves / armatures are able to enclose the pressured medium e.g. the ball in the ball valve. You have to relieve the pressure in the pipes in which the armture/valve is mounted.**

**Switch off pilot pressure and the power supply and relieve the pressure in the pipes.**

**If necessary set up warning signs in order to prevent**
- **the inadvertent starting up of the devices/machines/plants in which the armature/ valve is mounted**
- **the switching on of pilot medium supply, pilot power supply and/or the power supply of actuators and accessories.**

**In case of defect in the armature/valve make contact to the supplier. The telephone number will be found on the back cover of these mounting and installation manual.**

**If you ascertain a damage of the armature/valve, isolate the device from the mains. Please observe the safefy advices.**

**Do not mount, start or adjust the armature/valve if itself, the pipes or a mounted actuator will be damaged.**

**After the maintenance or repair check the right function of the armature/valve and the tightness of the pipe connections.**

**Also check the function of the accessories e.g. actuators, limit switches, etc.**

### 3.2 Device safety

The armatures/valves

- are quality products which are produced in accordance to the recognized industrial regulations.
- left the manufacturer`s work in a perfect safety condition.

**In order to maintain this condition, as installer / user you must carry out your task in accordance with the description in these instructions, technically correctly and with the greatest possible precision .**

We assume, as a trained specialist you are having mechanical and electrical knowledge!

**Satisfy yourself that the armatures/vales will only be used within their admissible limiting value (see the technical data) .**

**The armatures/valves must be used only for a purpose corresponding to their construction!**

**The armatures/valves must be used within the values specified in the technical data!**

**The operating of the armature/valve outside the nominal temperature range could destroy the sealings and the bearings.**

**The operating of the armatures/valves outside the nominal pressure range could destroy the inner parts and the body.**

STOP

**Never remove a cap or a other component part if the armature/valve will be under pressure.**

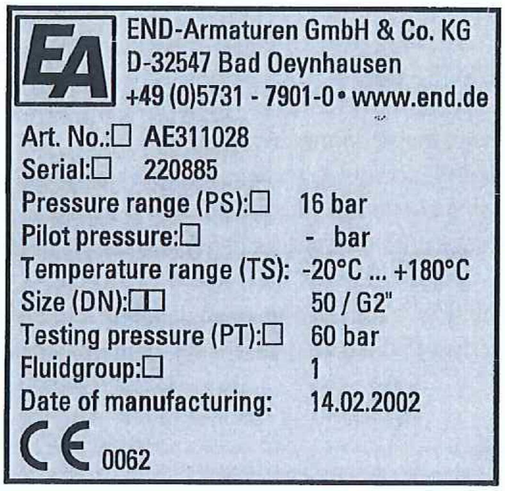
**Do not mount, start or adjust the armature/valve if itself, the pipes or a mounted actuator will be damaged.**

**After the maintenance or repair check the right function of the armature/valve and the tightness of the pipe connections.**

**Also check the function of the accessories e.g. actuators, limit switches, etc.**

## 4 Name-plate

In some cases the armatures/valves will be provided with a name- plate, which permitts a definite identification of the armatures/valves and shows the most important technical data to you. The name-plate should not be displaced or changed



END-Armaturen GmbH & Co. KG
D-32547 Bad Oeynhausen
+49 (0)5731 - 7901-0 • www.end.de
Art. No.:□ AE311028
Serial:□ 220885
Pressure range (PS):□ 16 bar
Pilot pressure:□ - bar
Temperature range (TS): -20°C ... +180°C
Size (DN):□□ 50 / G2"
Testing pressure (PT):□ 60 bar
Fluidgroup:□ 1
Date of manufacturing: 14.02.2002
CE 0062

Fig. 4.1 - Name-plate

| | |
|---|---|
| **Art.No.** | article number of the valve / armature |
| **Serial** | order- or production- number |
| **Pressure range (PS)** | max. admisable working pressure of the valve / armature [bar] |
| **Pilot pressure** | recommend pilot pressure for correct function of the valve / armature [bar] (only at pneumatic actuated valves / armatures) |
| **Size (DN)** | connecting size of the valve / armature |
| **Testing pressure (PT)** | testing pressure of the body of the valve / armature |
| **Fluidgroup** | allowed fluidgroup of the valve / armature |
| **Date of manufacturing** | month and year of manufacturing of the valve / armature |

# 5 Ball valves

## 5.1 General

**Before you are mount, adjust, start, operate or disassemble a ball valve you have to read the**

**→ Safety advices**

**If you have not read the safety advices until now, read this important advices now and turn back to this point.**

## 5.2 Corresponding use

Ball valves will be used to cut off medium flow.
It should only be used clean liquids and gases, on which the material of the ball valve will be resistant. Pollution or using outside the nominal pressure range and/or the nominal temperature range should causes damages on the armature especially on the seals.

In some cases you have to install an equalization boring into the ball, that there will be no overpressure between the body and the ball by changing temperatures.

## 5.3 Operation

The ball valve will be open or close totally by using a handle or an pneumatic or electric actuator (option).

**During the operation of the ball valve take care that there won`t be insert any objects or limbs into the armature.** Heavy injuries or damages will be the consequence. **If it is necessary you have to install a protective device.**

## 5.4 Mounting / Disassembly

The mechanical installation will be same at all variants of the ball valve. There will be differences in the type of connection.

Observe the flow direction: the handle should point at the flow direction.

Remove the package and the safety devices (e.g. caps or plugs). Take care that there will be no parts of the package or other parts in the armature.

Clean up the pipes in which the ball valve will be mounted. Pollution could affect the safety in operation and the duration of life of the armature. If necessary you have to install a Y- strainer in front of the ball valve.

Avoid stress in case of non align pipes.

### 5.4.1 Mounting with threaded connection

- Before lay on sealing compounds, check the hardly screwing by the pipes into the valve body.
- Lay on the correct sealing compounds on the pipes end. By using PTFE-ribbon or hemp sealings observe the screw direction. Don't use sealing compounds which are not prescribed for your employment.
- Screw the pipes into the connection ends of the valve. Don't use the handle as a lever.
- Strike up the pipes with pressure after that time the manufacturer of the sealing compounds pretends to harden it.
- Check the tightness of all connections.

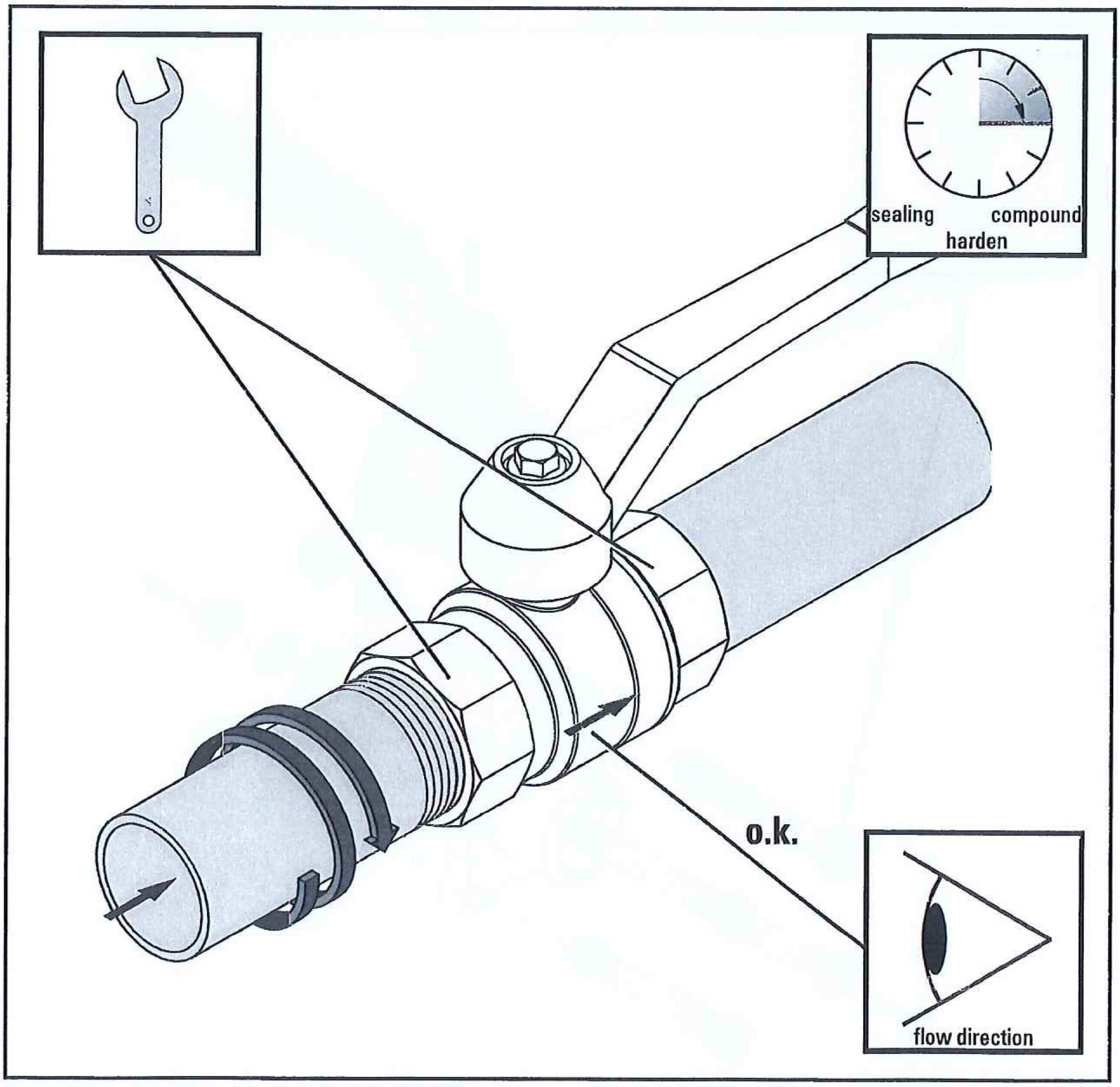


Fig. 5.1 - ball valves, mounting threaded connection (Fig.: Art. TB111025)

### 5.4.2 Mounting with welded connection

**Before welding you have to disassemble the center part of the ball valve to prevent the sealings from damages.**

#### 5.4.2.1 Disassembly of the center part of the ball valve

Clamp the valve between a vice carfully. By using guard plates you can prevent the damage of the ends of the body.

Loosen the nuts crossvice and remove the screws out of the body.

Take the center part of the ball valve. Observe, that you didn´t drop the sealings or the ball. Put the parts aside carefully. To attach the center parts and the connection ends at a later mounting you can sign the parts.

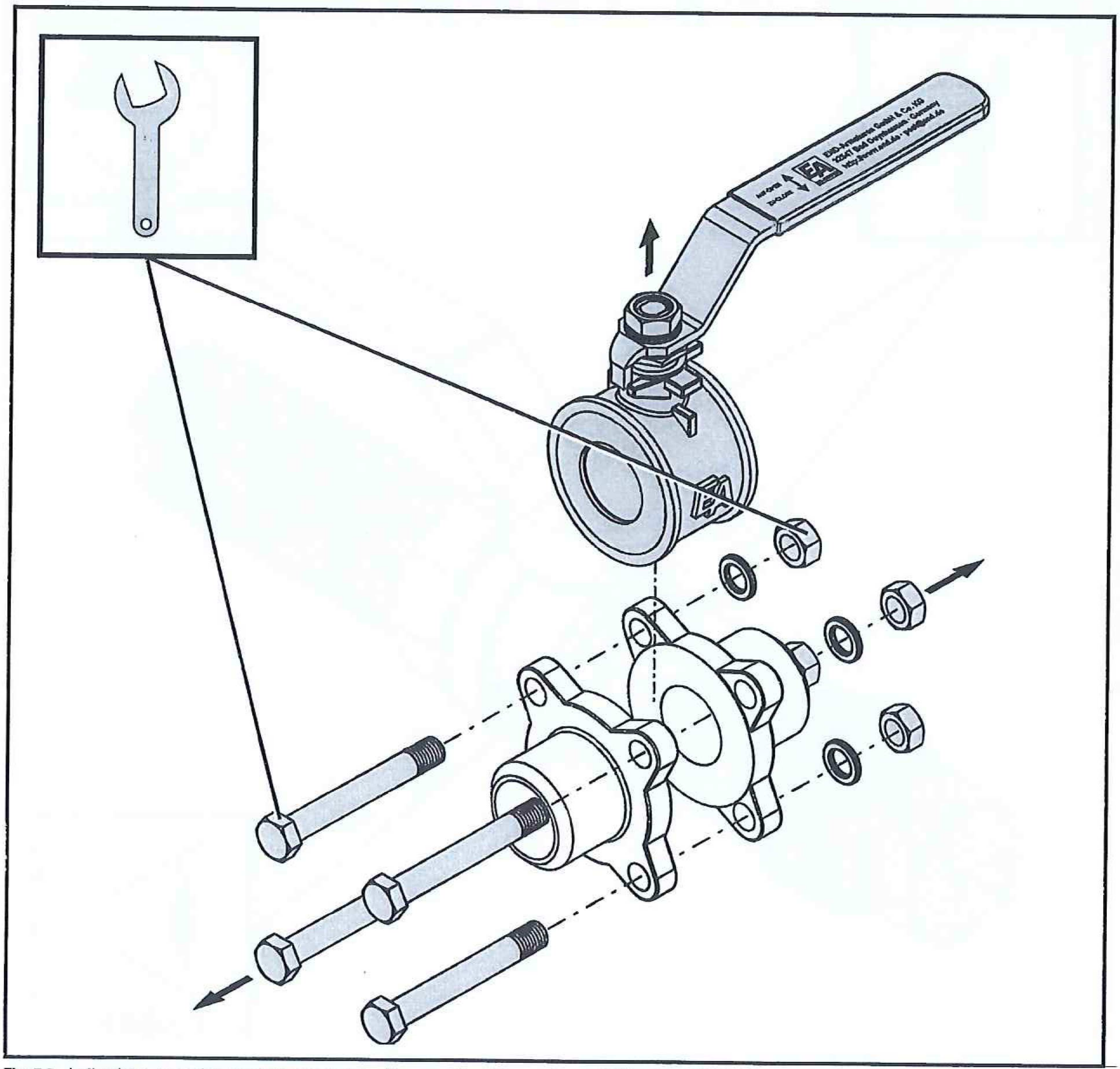


Fig. 5.2 - ball valves, mounting welded connection, disassembly of the center part (Fig.: Art. ZE311064)

### 5.4.2.2 Welding of the connection ends

The center part of the ball valve must be substitute by a distance part as long as the center part during the welding.

By welding the valve body with the pipes observe appropriate demands and guide lines.

**The safety demands by welding are depending on the place and the position of the point of weld. Welding the parts at a serviceable device/machine/plant the potential of danger is as higher as welding the parts in a welding room.**

**If appropriate, inform the shift foreman/safety engineer or the works manager and the fire brigade of your factory.**

**By welding observe your own national guide lines about safety and pevention of accidents.**

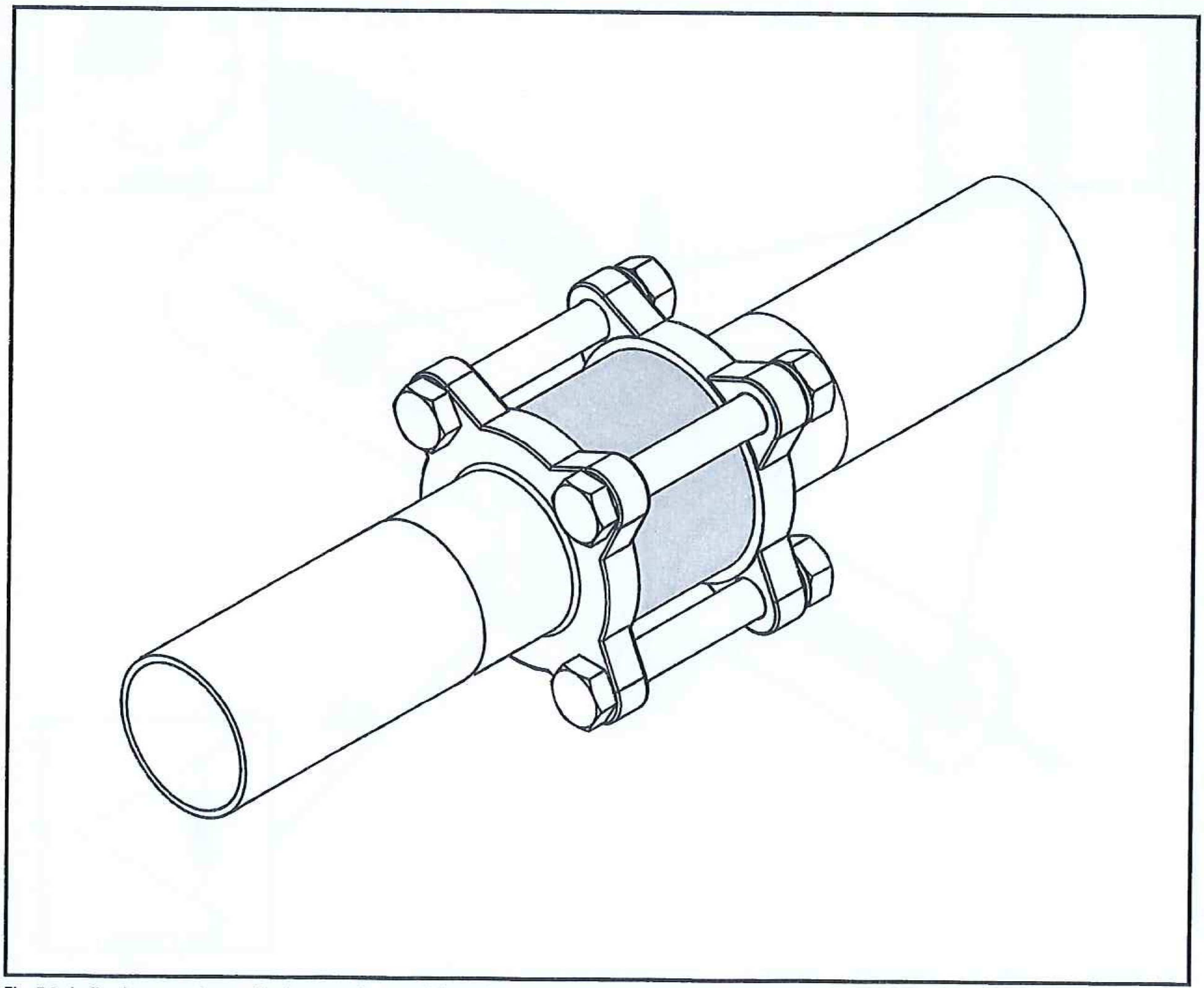


Fig. 5.3 -ball valves,mouting welded connections, welding of the connection ends(Fig.: Art. ZE311064)

### 5.4.2.3 Mounting of the center part

Before mounting the center part let the connection ends cool down.

Disassemble the distance part.

Insert the center part between the connection ends. Attach the center parts to the right connection ends.

Observe the correct seat of the sealings and that there will be no pollution in the seats of the sealings and in the ball.

Insert the screws into the borings of the connection ends.Tighten the nuts equally and crosswise. Observe the max. torque of the screws.

Check the function of the ball valve.

Check the tightness of all connections.

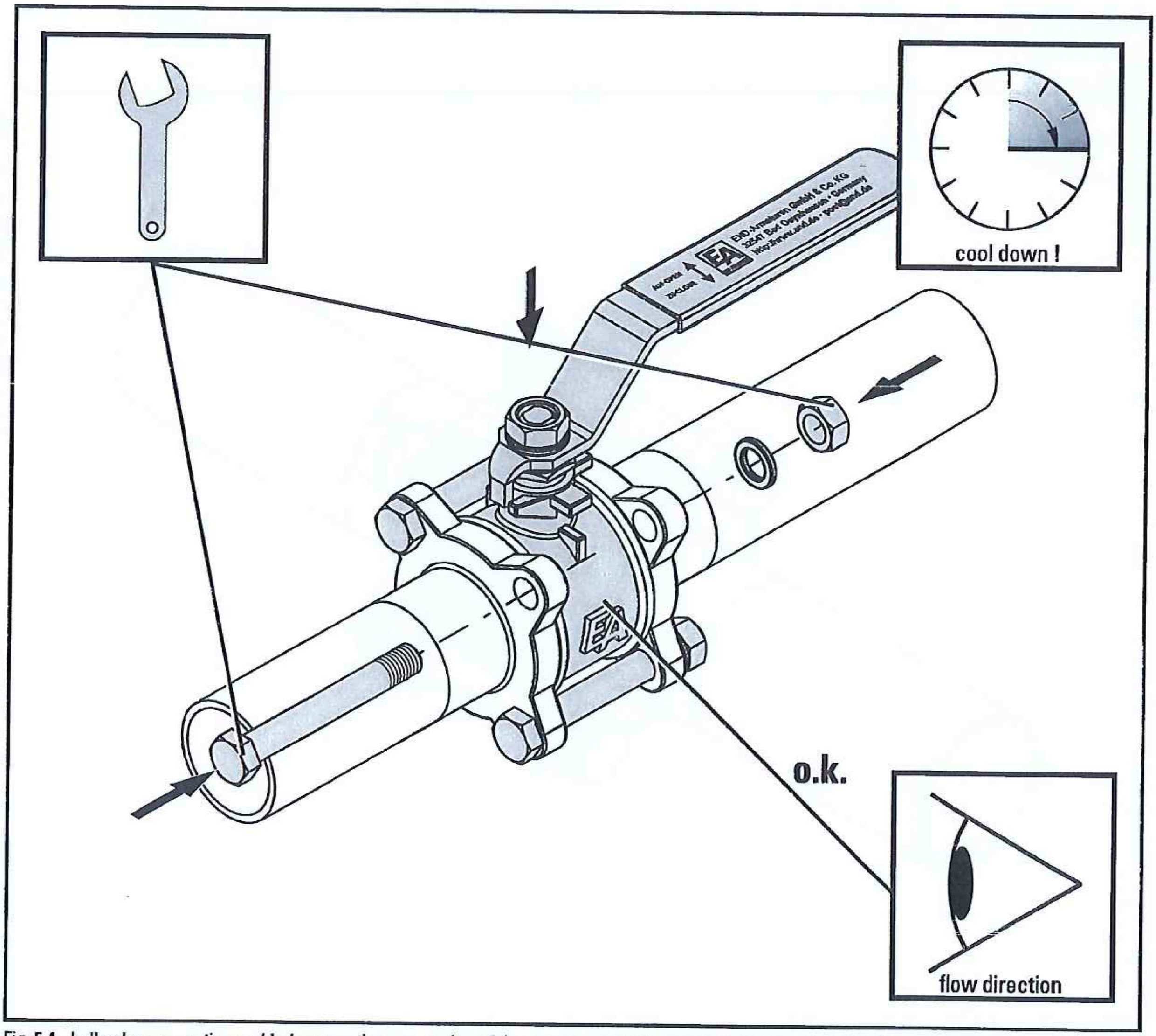


Fig. 5.4 - ball valves, mounting welded connections, mounting of the center part of the ball valve (Fig.: Art. ZE311064)

### 5.4.3 Mounting with flanged connection

**In the following discription we assume that you have mounted the flanges at the end of the pipes and the ball valve (welded flanges) and they are cooled down.**

Insert the ball valve and the flange sealings between the flanges.

Align the flange borings und put fit screws through the borings.

Put fit nuts on the screws and tighten them equally and crossvice. Observe the required and the max. torque of the ball valve, the flanges, the flanges seals and the screws.

Check the tightness of all connections.

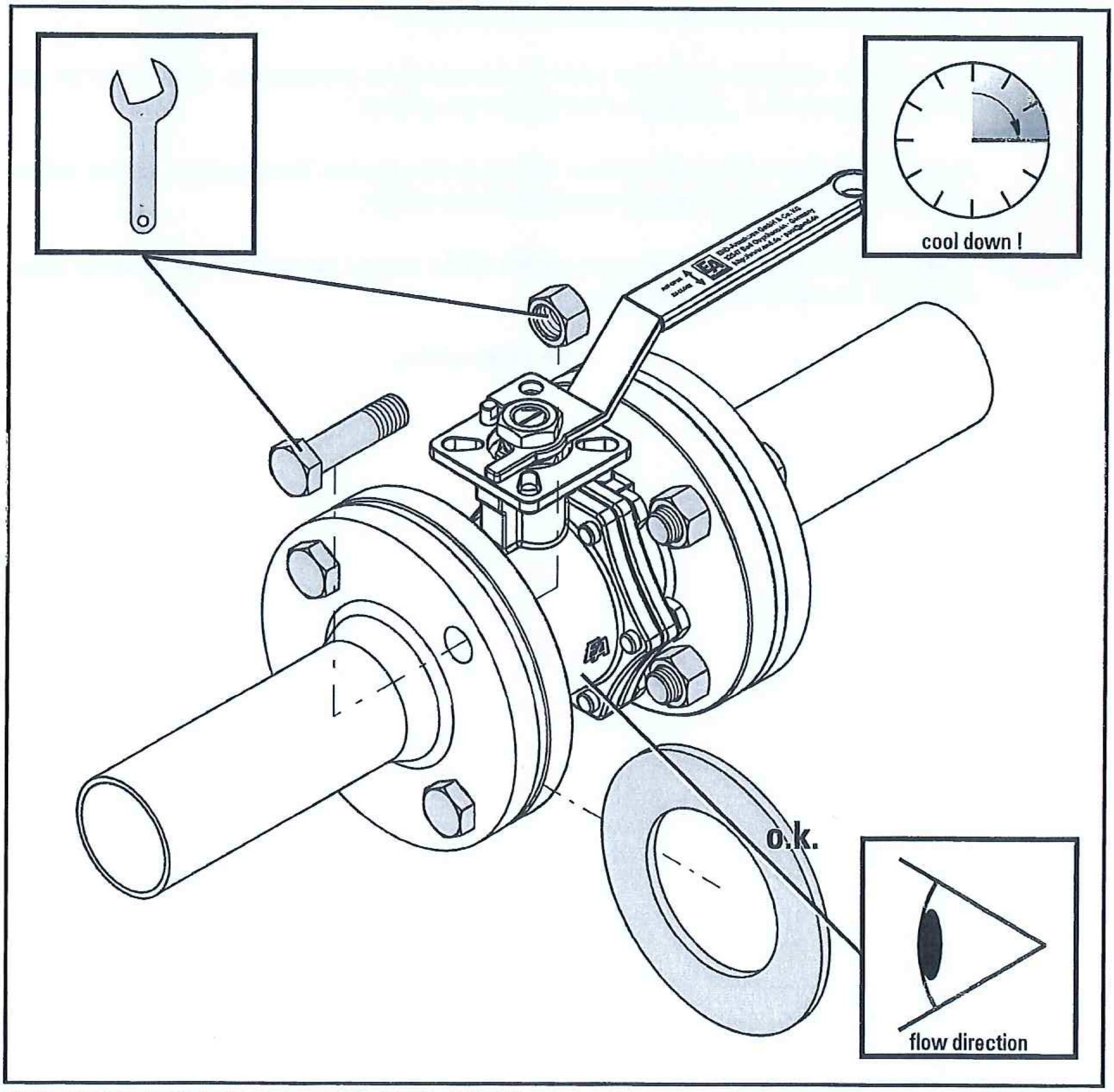


Fig. 5.5 - ball valves, mounting flanged connection (Fig.: Art. ZP311007)

## 5.5 Maintenance

**Before you maintain or shut down the valves you have to read the**

**→ Safety advice**

**If you have not read the safety advices until now, read this important advices now and turn back to this point.**

On normal accounts the ball valve is maintenance free.In periodical turns the controlling of the function and the tightness should happen:

- check the tighness of the gland
- check the tightness of the ball seats

Depending on the version of the ball valve for decreasing tightness at the stem the gland could be readjust. See also chapter 5.5.1. „Readjusting of the gland".

Ball valves in a multiple part design could be disassemble to exchange the seals and/or the ball. See also chapter: 5.5.2. „Exchange of the ball and the sealings".

**In case of a defect of the valve make a contact to the supplier. The telephone number will be found on the back or these operation and installation manual.**

**If you ascertain a demage of the valve switch off the device/ machine/ plant! However before doing this, it is essential to refer to the**

**→ Safety advice.**

### 5.5.1 Readjusting of the gland

For decreasing tightness at the stem the gland could be readjust.

By keeping the nominal pressure you have to tighten up the screw of the gland until the tightness of the the gland will be restored

After the readjusting the ball of the valve must be able to move slightly.

At ball valves with spring forced sealings or o-ring sealings at the stem the readjustment isn't necessary.

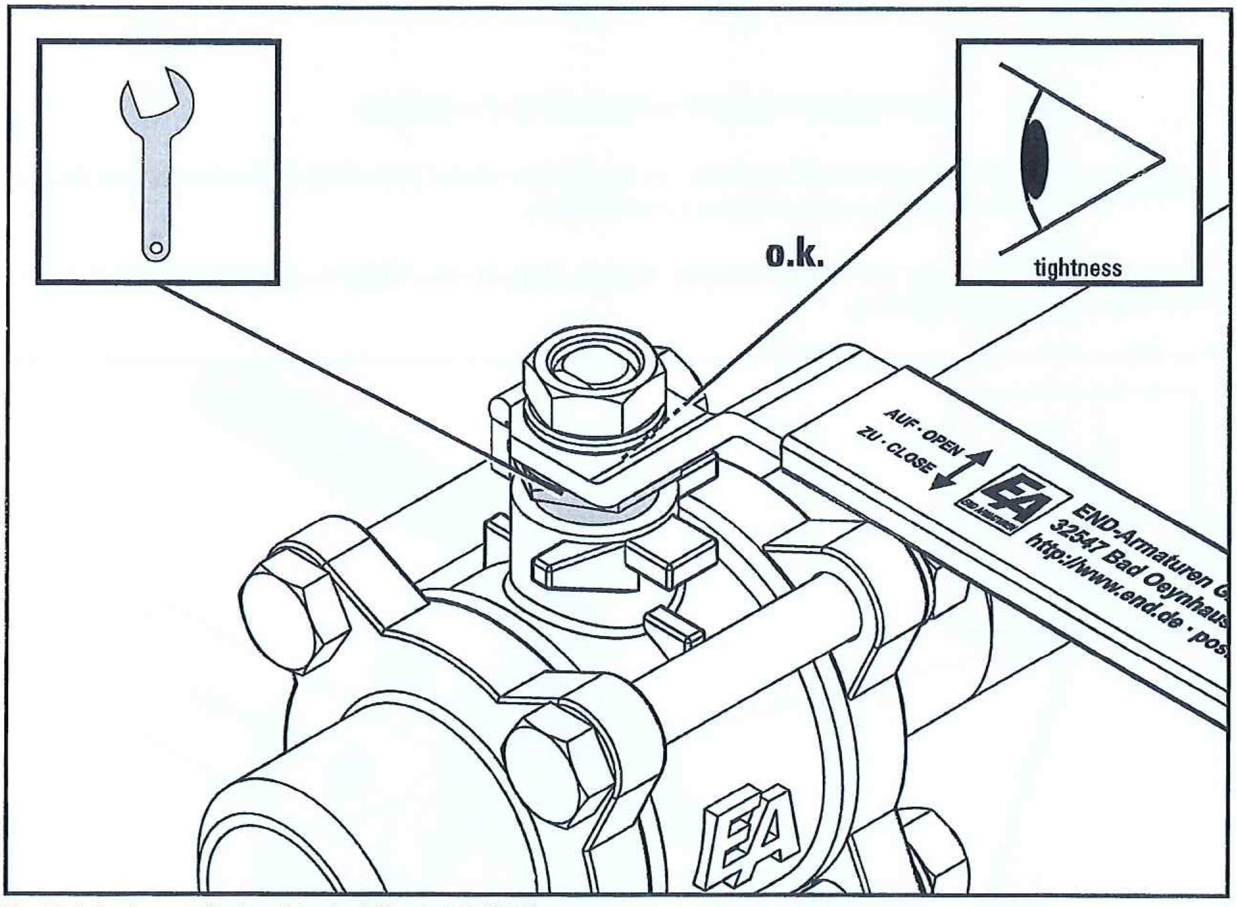


Fig. 5.6 - ball valves, readjusting of the gland (Fig.: Art. ZE311064)

### 5.5.2 Exchange of the ball and the sealing

For decreasing tightness the ball and/or the sealings of the ball valve could be exchange. The availability of the spare parts kit you can see in the data sheet of your ball valve.

Corresponding to the wear of the parts exchange the sealings and the ball. By the replacement of the ball you should also exchange the sealing.

In the following description we assume, that your ball valve will be actuated by hand. If your ball valve will be actuated be a pneumatic or electric actuator, please also observe the opration and installation manual of the actuator.

Cut off the media flow and relieve the media pressure.

Keep ready some fit tanks to catch up leaking liquids.

If it`s necessary remove the additional limt switches and gear boxes.

#### 5.5.2.1 3-part ball valve with threaded or welded connection

At 3-part ball valve it will do when you remove the center part of the ball valve. Loosen the nuts crosswise and remove the screws out of the body.

Take the center part of the ball valve. Observe, that you didn´t drop the sealings or the ball. Put the parts aside carefully.

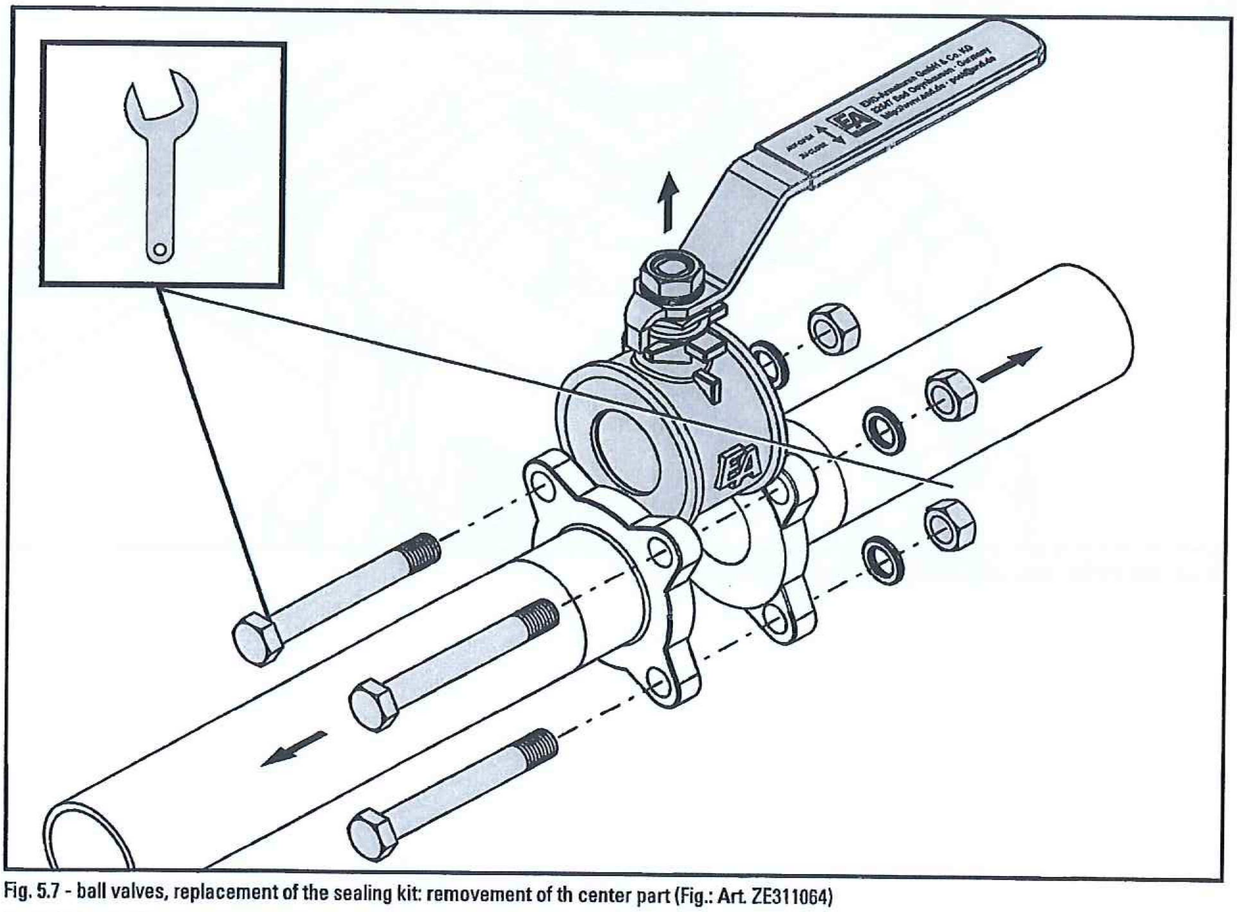


Fig. 5.7 - ball valves, replacement of the sealing kit: removement of th center part (Fig.: Art. ZE311064)

## Ball valves

**Observe that ball valves could enclose medium inside the ball.**

Take the parts aside carefully. Place a mark on the body and the connection ends that you will be able to join the correct parts by a subsequent mounting.

Remove the ball seals and the ball out of the body.

**Perhaps you have to turn the handle to remove the ball out of the body. Do not insert any limbs into the ball valve. Heavy injuries will be the consequences.**

Loosen the nut of the handle and take the handle and all discs und washers aside.

Depending on the version of the ball valve loosen the nut on the stem or loosen the gland nut

Remove the stem and all other sealings, washers and discs out of the body.

Clean all parts and check them for damages.

Throw away the old pieces by observing the appropriate demands and guide lines.

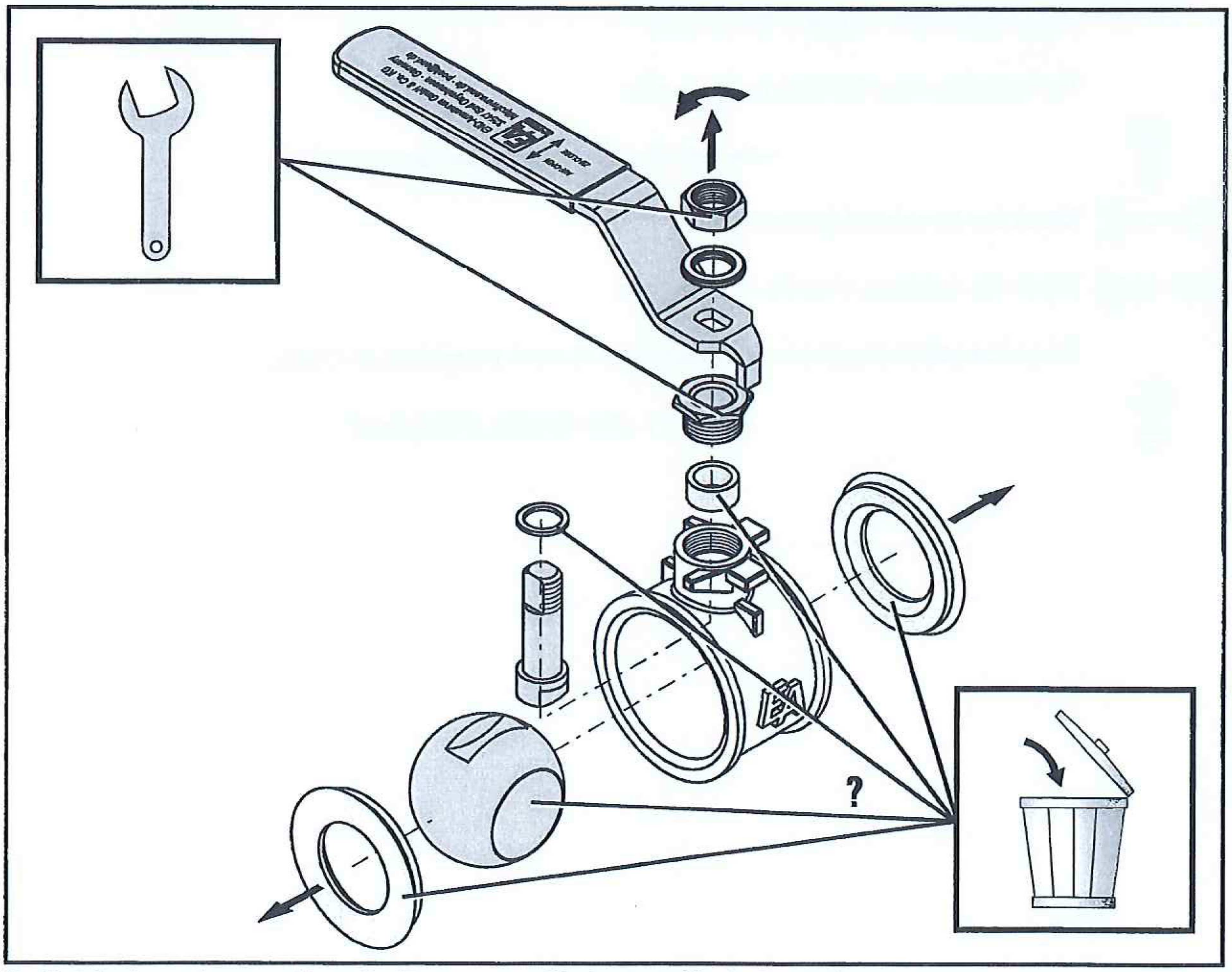


Fig. 5.8 - ball valves, replacement of the sealing kit: removement of the inner parts (Fig.: Art. ZE311064)

Make the stem with the new sealings and discs complete.

Insert the stem from the inside into the body.

Depending on the version of the ball valve mount the other sealings, discs and spring washers at the stem, and screw the nut or the gland nut onto the stem.

Insert the ball into the body. The dihedral of the stem must engage in the grove of the ball. If need be you have to turn the stem.

Put the handle onto the stem. Observe the correct function of the limit switches and take care that the handle and the boring of the ball will align.

Fix the nut of the handle onto the stem and tighten it.

Put the ball sealings and the ball into their seats at the center part of the ball valve. Observe, that you didn´t drop the sealings or the ball.

Before mounting the center part clean the connection ends at the end of the pipes.

Move the center part of the body between the connection ends. If need be arange the center parts to the correct connection ends.

Insert the screws into the borings of the connection ends.Tighten the nuts equally and crosswise. Observe the max. torque of the screws.

For mounting read the advices at chapter

→ **5.4.2.3. „Mounting of the center part".**

Check the function of the ball valve.

Check the tightness of all the connections.

If need be adjust the gland of the stem. Please read the advices at chapter

→ **5.5.1. „Readjusting of the gland".**

### 5.5.2.2 Multiple part ball valve with flanged connection

Remove the ball valve out of the pipes. Loosen the flange screws and pull the screws out of the flange.

Take the ball valve from the pipes.

Throw away the old pieces by observing the appropriate demands and guide lines.

Dismantle the ball balve. Depending on the version of the ball valve:

- you have to screw out the screw of the body, or
- you have to screw the screw joint out of the body.

Observe, that you didn´t drop the sealings or the ball.

**Observe that ball valves could enclose medium inside the ball.**

Put the parts aside carefully. Place marks on the parts that you will be able to join the correct parts by a subsequent mounting of the ball valve.

Remove the ball sealing and the ball out of the body.

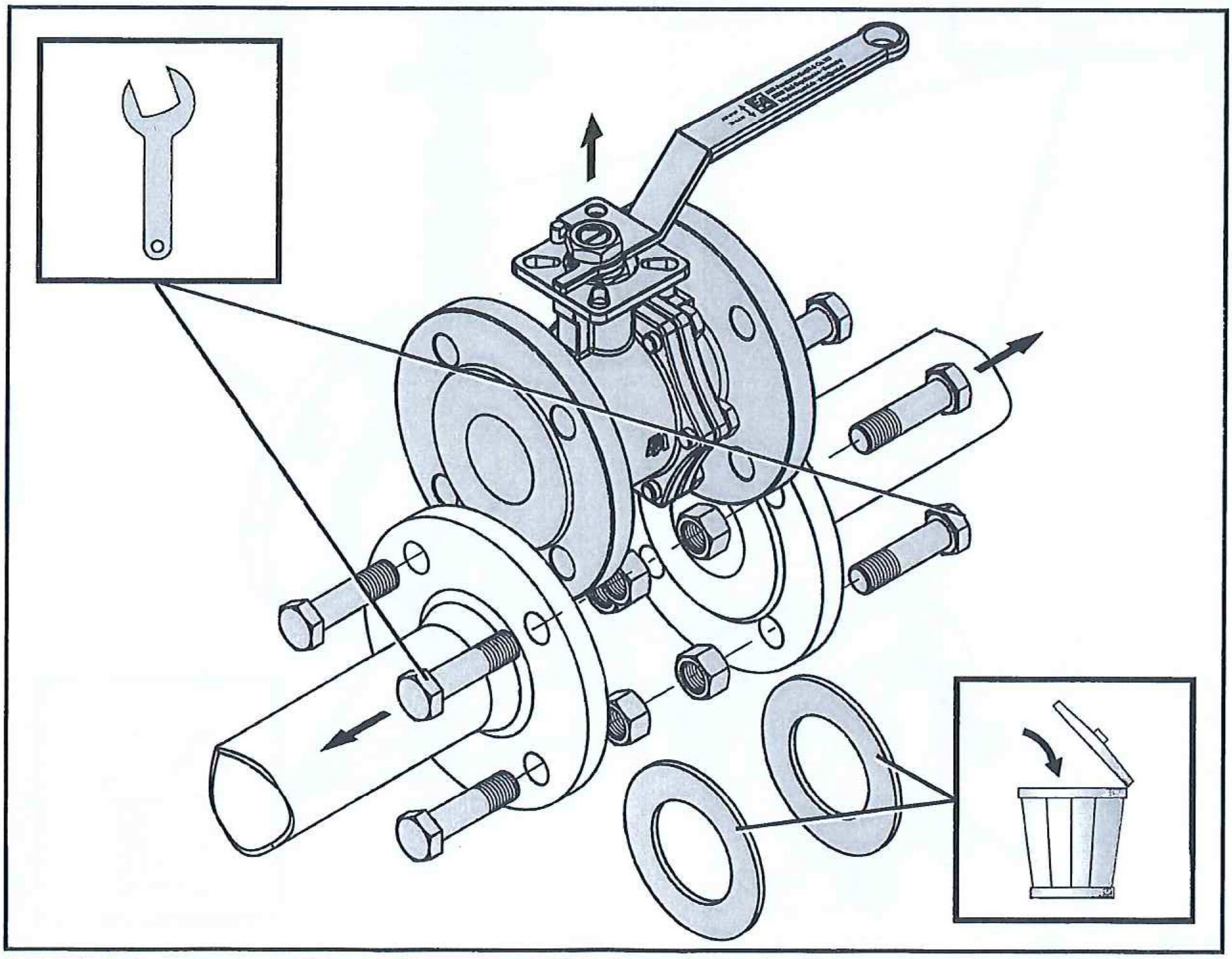


Fig. 5.9 - Ball valves, replacement of the sealing kit: removement of the ball valve (Fig.: Art. ZP311007)

**Perhaps you have to turn the handle to remove the ball out of the body. Do not insert any limbs into the ball valve. Heavy injuries will be the consequences..**

- Remove the second ball sealing.
- Loosen the nut of the handle and take the handle and all discs und washers aside.
- Depending on the version of the ball valve loosen the nut on the stem or loosen the gland nut
- Remove the stem and all other sealings, washers and discs out of the body.
- Clean all parts and check them for damages.
- Throw away the old pieces by observing the appropriate demands and guide lines.

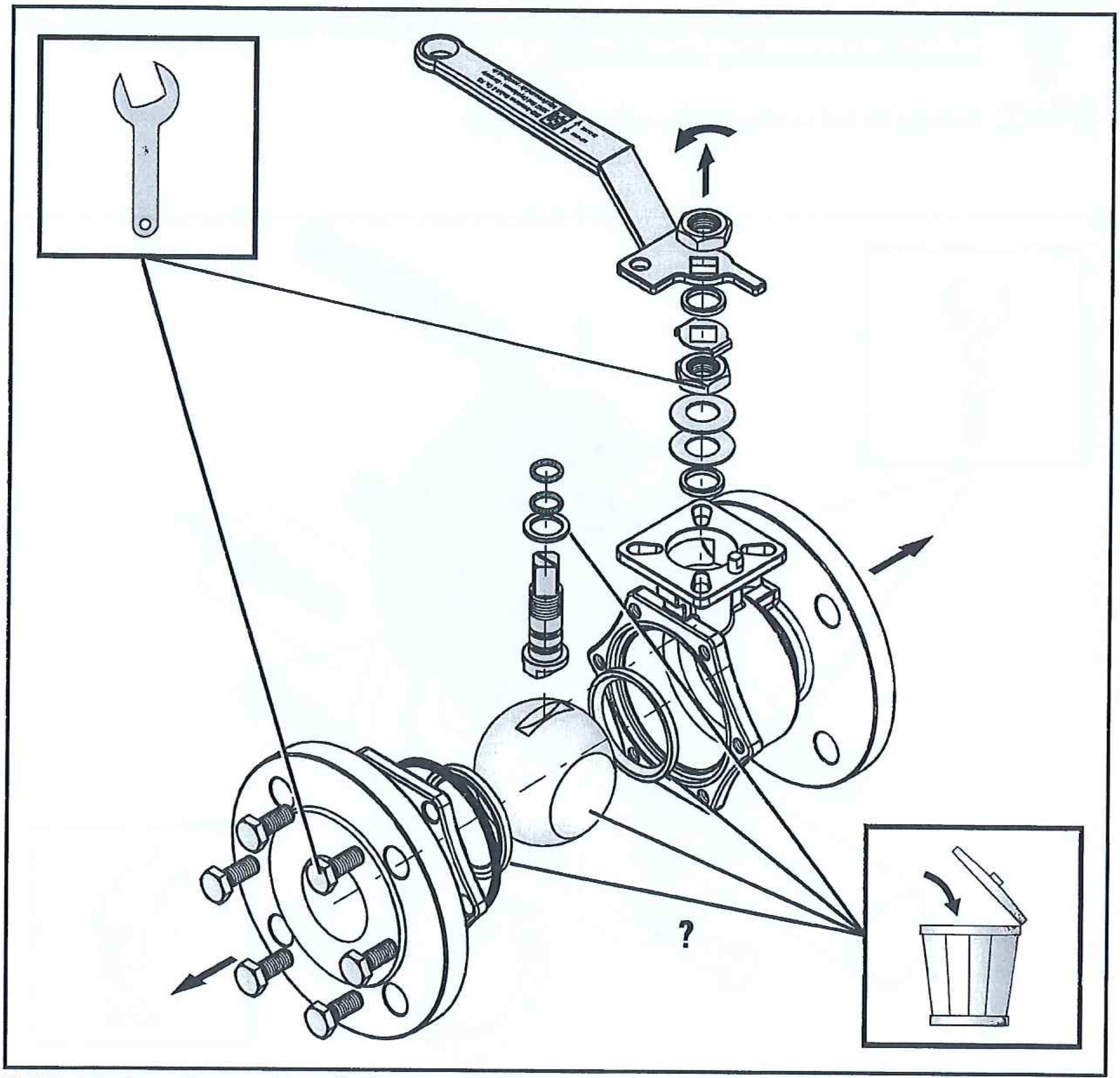


Fig. 5.10 - ball valves, replacement of the sealing kit: removement of the inner parts (Fig.: Art. ZP311007)

Make the stem with the new sealings and discs complete.

Insert the stem from the inside into the body.

Depending on the version of the ball valve mount the other sealings, discs and spring washers at the stem, and screw the nut or the gland nut onto the stem.

Place the first ball seal into the seat in the body.

Insert the ball into the body. The dihedral of the stem must engage in the grove of the ball. If need be you have to turn the stem.

Place the second ball seal into the seat in the body.

Assemble the ball valve. Depending on the version of the ball valve:

- you have to join the parts of the body together and to screw them up with the fit screws; or
- you have to screw up the screw joint with the body.

If need be attach the different parts of the boby.

Put the handle onto the stem. Observe the correct function of the limit switches and take care that the handle and the boring of the ball will align.

Fix the nut of the handle onto the stem and tighten it.

Before mounting the center part clean the connection ends at the end of the pipes.

Insert the ball valve with new flange sealings between the flanges.

Align the flange borings und put fit screws through the borings.

Put fit nuts on the screws and tighten them equally and crossvice. Observe the max. torque of the screws.

For mounting read the advices at chapter

→ **5.4.3 „Mounting with flanged connection".**

Check the function of the ball valve.

Check the tightness of all the connections.

If need be adjust the gland of the stem. Please read the advices at chapter

→ **5.5.1. „Readjusting of the gland".**

END ARMATUREN

*Qualität von Anfang an.*

(1)
# Declaration in conformity

(2)
## as defined by Pressure-Equipment-Directive 97/23/EC

(3) This declaration apply to the article groups with the nominal sizes:

| Articles | Nominal size |
|---|---|
| **Butterfly valves** | |
| HA | DN50 ... DN300 |
| TA | DN40 ... DN300 |
| WA | DN50 ... DN300 |
| WM | DN50 ... DN300 |
| **Gate valves** | |
| AB | 1¼" ... 2" |
| AE | 1¼" ... 3" |
| AE | DN32 ... DN80 |
| CA5014 | DN100 ... DN300 |
| CA5015 | DN65 ... DN300 |
| CA5214 | DN40 ... DN200 |
| CD5010 | DN32 ... DN200 |
| CV3010 | DN32 ... DN150 |
| CV5010 | DN32 ... DN200 |
| CV5020 | DN32 ... DN200 |
| **Pressure reducer** | |
| SD | ⅜" ... 2" |
| SD | DN32 ... DN80 |
| **Pressure relief valves** | |
| NG | 1¼" ... 1½" |

| Articles | Nominal size |
|---|---|
| NG | DN32 ... DN100 |
| **Ball valves** | |
| AG | 1¼" ... 2" |
| BK | DN32 ... DN100 |
| EK | 1¼" ... 3" |
| GD | 1¼" ... 2" |
| IK | 1¼" ... 2" |
| IL | 1¼" ... 4" |
| IW | 1¼" ... 2" |
| KA | 1¼" ... 3" |
| PD | 1¼" ... 2" |
| PE | 1¼" ... 4" |
| TB | 1¼" ... 4" |
| TF | DN32 ... DN200 |
| TH | 1¼" |
| VD | 1¼" ... 4" |
| VD | DN32 ... DN100 |
| VH | 1¼" ... 2" |
| VH3100 | 1¼" ... 2" |
| VK | DN32 ... DN200 |
| VK/PN40 | DN32 ... DN200 |

| Articles | Nominal size |
|---|---|
| VL | 1¼" ...2", 3" |
| VN | 1¼" ... 2" |
| VO | DN32 ... DN200 |
| VS | DN32 ... DN200 |
| VT | DN32 ... DN100 |
| VU | 4" |
| ZA | 1¼" ... 4" |
| ZA | DN32 ... DN100 |
| ZB | 1¼" ... 2" |
| ZB | DN32 ... DN50 |
| ZD | 1¼" ... 4" |
| ZD | DN32 ... DN100 |
| ZE | 1¼" ... 4" |
| ZE | DN32 ... DN100 |
| ZF | 1¼" ... 4" |
| ZG | 1¼" ... 2" |
| ZH | 1¼" ... 2" |
| ZK | DN32 ... DN100 |
| ZL | 1¼" ... 3" |
| ZM | 1¼" ... 2" |
| ZP | DN32 ... DN200 |

| Articles | Nominal size |
|---|---|
| ZU | 1¼" ... 3" |
| **Non-return valves** | |
| AR | 1¼" ... 2" |
| CK3003 | DN65 ... DN200 |
| CK5003 | DN32 ... DN200 |
| CK5100 | DN65 ... DN250 |
| CK5200 | DN65 ... DN250 |
| CW5400 | DN65 ... DN250 |
| EB | 1¼" ... 3" |
| EB | DN32 ... DN80 |
| RG1300 | DN32 ... DN100 |
| RG33xx | DN32 ... DN200 |
| RK | DN32 ... DN400 |
| TD | 4" |
| **Strainer** | |
| AS | 1¼" ... 3" |
| AS | DN32 ... DN200 |
| EA | 1¼" ... 3" |
| EA | DN32 ... DN80 |

and all variations of these articles

(4) of the company

**END-Armaturen GmbH & Co. KG**
D-32547 Bad Oeynhausen
Germany

(5) Herewith we declare that the above-mentioned articles in the conditions of our delivery are in conformity with the regulations of the Pressure Equipment Directive 97/23/EG.

(6) Applied conformity assessment procedure: Modul H.

(7) Notified body for conformity assessment PED an Quality-Management-System:

BUREAU VERITAS

**Bureau Veritas S.A.**
Paris / Frankreich
Kennzeichen 0062

(8) Certificate numbers:

| | |
|---|---|
| Quality Management System: | INT110198DE |
| Certificate of System approval PED: | 2011/70.10.1777/P |

(9) Applied harmonized standards, in particular:

**DIN EN 12516:2005** **Industriearmaturen - Gehäusefestigkeit**

(10) On behalf

Bad Oeynhausen, 17. january 2012

END-Armaturen GmbH & Co. KG
Oberbeckstener Str. 78
32547 Bad Oeynhausen · Germany
Telefon: +49 (0)5731 - 7900-0
Telefax: +49 (0)5731 - 7900-199
http://www.end.de · post@end.de

Friedhelm König
Technical Manager

Michael End
Quality Manager

Declaration without signature or company stamp shall not be valid. The declaration may be circulated only without alternation. Extracts or alternations are subject to approval by END-Armaturen GmbH & Co. KG.

*Qualität von Anfang an.*

(1)

# Declaration in conformity

(2)

## as defined by Pressure-Equipment-Directive 97/23/EC

(3) This declaration apply to the article groups with the nominal sizes:

| Articles | Nominal size |
|---|---|
| **Gate valves** | |
| AA | ½" ... 2" |
| AB | ¼" ... 1" |
| AC | ⅛" ... 2" |
| AD | ½" ... 2" |
| AE | ½" ... 1", DN15 ... DN25 |
| AV | ¼" ... 1" |
| BE | ⅜" ... 3" |
| BF | ¼" ... 3" |
| BS | ½" ... 1¼" |
| CA5014 | DN40 ... DN80 |
| CA5015 | DN40 ... DN50 |
| CA5214 | DN40 ... DN32 |
| CD5010 | DN15 ... DN25 |
| CV3010 | DN15 ... DN25 |
| CV5010 | DN15 ... DN25 |
| CV5020 | DN15 ... DN25 |
| IC | ¼" ... 4" |
| MV | ½" |
| TC | ¼" ... 4" |
| **Pressure reducer** | |
| ID | ⅜" ... ¾" |
| MB | ½" ... 2" |
| MC | ½" ... 2" |
| SD | ⅜" ... 1", DN20 ... DN25 |
| **Pressure relief valves** | |
| NG | ⅜" ... 1", DN15 ... DN25 |
| **Ball valves** | |
| AG | ¼" ... 1" |
| BC | ⅛" ... ¾" |
| BK | DN15 ... DN25 |

| Articles | Nominal size |
|---|---|
| BO-BO | ½" ... 2" |
| BT | ½" ... 1" |
| BV | ¼" ... ¾" |
| CB | ¼" ... 2½" |
| EK | ¼" ... 1" |
| GD | ¼" ... 1" |
| HF | ¼" ... 1" |
| HO | DN10 ... DN15 |
| IB | ¼" ... 2" |
| IK | ¼" ... 1" |
| IL | ¼" ... 1" |
| IW | ¼" ... 1" |
| KA | ½" ... 1" |
| KFE | ⅜" ... ¾" |
| NK | ⅜" ... 4", DN10 ... DN100 |
| PB | ⅛ ... 2" |
| PD | ½" ... 1" |
| PE | ¼" ... 1" |
| SK | ½" ... 3", DN10 ... DN80 |
| TB | ¼" ... 1" |
| TE | ½" ... 2" |
| TF | DN20 ... DN25 |
| TH | ½" ... 1" |
| TT | ⅜" ... 1" |
| TV | ⅜" ... 1" |
| VD | ¼" ... 1" |
| VD | DN10 ... DN25 |
| VE | ¼" ... 1" |
| VF | ⅛" ... ½" |
| VH | ⅛" ... 1" |
| VH3100 | ½" ... 1" |

| Articles | Nominal size |
|---|---|
| VK | DN15 ... DN25 |
| VL | ¼" ... 1" |
| VN | ¼" ... 1" |
| VO | DN25 |
| VS | DN15 ... DN25 |
| VT | DN15 ... DN25 |
| ZA | ¼" ... 1", DN10 ... DN25 |
| ZB | ¼" ... 1", DN15 ... DN25 |
| ZD | ½" ... 1", DN15 ... DN25 |
| ZE | ¼" ... 1", DN10 ... DN25 |
| ZF | ¼" ... 1" |
| ZG | ¼" ... 1" |
| ZH | ½" ... 1" |
| ZK | DN15 ... DN25 |
| ZL | ¼" ... 1" |
| ZM | ¼" ... 1" |
| ZP | DN15 ... DN25 |
| ZU | ¼" ... 1" |
| **Pipe fittings** | |
| FG | ⅛" ... 4" |
| FS | DN15 ... DN150 |
| GE | Ø6 ... Ø20 |
| GR | Ø8 ... Ø28 |
| GV | Ø6 ... Ø20 |
| TE | Ø6 ... Ø25 |
| TV | Ø6 ... Ø20 |
| WE | Ø6 ... Ø38 |
| WV | Ø6 ... Ø20 |
| **Non-return valves** | |
| AH | ¼" ... 1½" |
| AR | ½" ... 1" |

| Articles | Nominal size |
|---|---|
| BH | ⅜" ... 3" |
| CK3003 | DN15 ... DN50 |
| CK5000 | DN40 ... DN250 |
| CK5003 | DN40 ... DN25 |
| CK5100 | DN40 ... DN50 |
| CK5200 | DN40 ... DN50 |
| CW5400 | DN40 ... DN50 |
| DR | DN50 ... DN300 |
| EB | ½" ... 1", DN15 ... DN25 |
| MR | ¼" ... 3" |
| RG | DN15 ... DN25 |
| TD | ⅜" ... 3" |
| TG | ½" ... 2" |
| TR | ⅜" ... 4" |
| VB | ¼" ... 2" |
| ZR | DN15 ... DN200 |
| **Sight glasses** | |
| SG | ¼" ... 2", DN15 ... DN150 |
| **Strainer** | |
| AS | ¼" ... 1" |
| AS | DN15 ... DN25 |
| BG | ⅜" ... 2" |
| CU | DN15 ... DN250 |
| EA | ½" ... 1", DN15 ... DN25 |
| IG | ¼" ... 4" |
| KU | DN15 ... DN100 |
| STE | DN25 ... DN150 |
| **Water-shock damper** | |
| TS | ½" |

and all variations of these articles

(4) of the company

**END-Armaturen GmbH & Co. KG**
D-32547 Bad Oeynhausen
Germany

(5) Herewith we declare that the above-mentioned articles in the conditions of our delivery are in conformity with the regulations of Article 3 Part 3 of the directive 97/23/EG. These products bear no CE mark, but are in line to the good engineering practice designed and manufactured.

(6) Applied harmonized standards, in particular:

**DIN EN 12516:2005** **Industriearmaturen - Gehäusefestigkeit**

(7) On behalf

END-Armaturen GmbH & Co. KG
Oberbecksener Str. 78
32547 Bad Oeynhausen · Germany
Telefon: +49 (0)5731 - 7900-0
Telefax: +49 (0)5731 - 7900-199
http://www.end.de · post@end.de

Bad Oeynhausen, 17. january 2012

Friedhelm König
Technical Manager

Michael End
Quality Manager

Declaration without signature or company stamp shall not be valid. The declaration may be circulated only without alternation. Extracts or alternations are subject to approval by END-Armaturen GmbH & Co. KG.

# L Type

## Carbon, stainless or duplex steel body

### Accumulatore con membrana sostituibile

**Caratteristiche tecniche**

| | |
|---|---|
| Pressione di esercizio: | max. 150/210/250 bar |
| Precarica gas (solo azoto): | max. 90% P min. di esercizio |
| Rapporto pressione ammessa: | max. ≤ 6/1 |
| Temperatura di esercizio: | -40 +150°C (compatibilmente con le temperature ammesse dalla membrana) |
| Montaggio: | orizzontale o verticale con valvola gas rivolta verso l'alto |

**Caratteristiche costruttive standard**

| | |
|---|---|
| Costruzione corpo: | acciaio al carbonio<br>acciaio inox AISI 316L<br>acciaio duplex F51 |
| Membrana: | secondo fluido |
| Valvola attacco gas: | 5/8"UNF versione 1 |
| Verniciatura: | fondo antiruggine (solo per acciaio al carbonio) |
| Collaudo: | a richiesta |

### Accumulator with exchangeable diaphragm

**Technical data**

| | |
|---|---|
| Operating pressure: | max. 150/210/250 bar |
| Gas filling (nitrogen only): | max. 90% of min. operating pressure |
| Admissible pressure ratio: | max. ≤ 6/1 |
| Operating temperature: | -40 +150°C (Compatible with the temperatures admitted for the diaphragms) |
| Mounting: | horizontal or vertical with gas valve upwards |

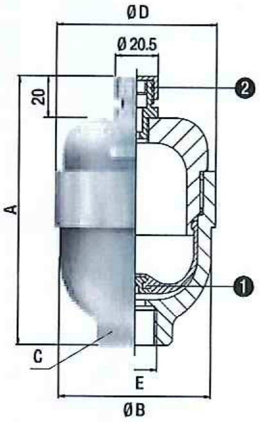
**Standard construction characteristics**

| | |
|---|---|
| Material of body: | carbon steel<br>stainless steel AISI 316L<br>duplex steel F51 |
| Diaphragm: | according to fluid |
| Gas connection valve: | 5/8"UNF version 1 |
| Painting: | anti-rust primer (only carbon steel) |
| Test: | on request |

**Dimensioni / Dimensions / Abmessungen**

| | | | Stainless steel | Carbon steel | Duplex steel | Stainless-Duplex steel | Carbon steel | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Tipo | Volume* | Pressione | | | Attacco lato liquido | | Valvola gas | A | ØB | C | ØD | Peso |
| | Type | Volume* | Pressure | | | P.F.C. | | Gas valve | | | | | Weight |
| | | cm³ | max bar | | | E | | Tappo Plug Bouton Zapfen | mm | | | | kg |
| | L 0.025 | 25 | 150 | - | 210/250 | 1/2" GAS | | Plug • 5/8"UNF | 105 | | | 65 | 1,2 |
| 12.0100 E NBR | L 0.05 | 50 | 150 | - | 210/250 | 1/2" GAS | | Plug • 5/8"UNF | 105 | | | 65 | 1,2 |
| 12.0110 E Viton | L 0.1 | 100 | 150 | 210 | 210/250 | 1/2" NPT | M18x1,5 | M28x1,5 • 5/8"UNF | 128 | 73 | 36 | 77 | 1,9 |
| 12.0101 E NBR | L 0.35 | 350 | 150 | 210 | 210/250 | 1/2" NPT | M18x1,5 | M28x1,5 • 5/8"UNF | 157 | 94 | 40 | 99,5 | 2,9 |
| 12.0601 E Viton | Type | Volume* | Pression | | | Connection fluide | | Valve pour Gaz | | | | | Poids |
| 12.0111 E Viton | Typ | Volumen* | Druck | | | Medium Anschluss | | Gasventil | A | ØB | C | ØD | Gewicht |

* Volume nominale - Nominal volume - Nominal Volumen



**Codice ricambi / Spare parts code / Code pièces de rechange / Ersatzteil Schlüssel**

| Tipo | Membrana | Valvola gas |
|---|---|---|
| Type | Diaphragm | Gas valve |
| | ① | ② |
| L 0.1 | MEML01* | VALPRE580NV1 - VALPRE58X |
| L 0.35 | MEML035*NV1 | VALPRE580NV1 - VALPRE58X |
| Type | Membrane | Valve de gonflage |
| Typ | Membran | Gasventil |

* Secondo fluido - According to fluid - Selon fluide - Nach Medium

### Accumulateur avec membrane remplaceable

**Caractéristiques techniques**

| | |
|---|---|
| Pression de travail: | max. 150/210/250 bar |
| Gonflage (uniquement azote): | max. 90% de la pression de travail inférieure |
| Rapport de pression admissible: | max. ≤ 6/1 |
| Temperature de travail: | -40 +150°C (Compatible avec les températures admis pour les membranes) |
| Montage: | indifférente horizontal ou vertical avec raccordement gaz vers dessus |

**Caractéristiques constructives standard**

| | |
|---|---|
| Corps: | acier aù carbone forgé<br>acier inoxidable AISI 316L<br>duplex acier F51 |
| Membrane: | selon fluide |
| Valve de gonflage: | 5/8"UNF exécution 1 |
| Protection: | primer anti-rouille (seulement acier aù carbone forgé) |
| Réception: | sur demande |

### Druckspeicher mit Auswechselbarer Membran

**Technische Angaben**

| | |
|---|---|
| Betriebsdruck: | max. 150/210/250 bar |
| Gasfüllung: (Ausschließlich Stickstoff) | max. 90% vom min. Betriebsdruck |
| Zugelassenes Druckverh: | max. ≤ 6/1 |
| Betriebstemperaturbereich: | -40 +150°C (Kompatibel mit die fuer die Membranen zugelassene Temperatur) |
| Montage: | beliebig Waagrecht oder Senkrecht mit Gasventil nach oben |

**Standard Konstruktionsmerkmale**

| | |
|---|---|
| Gehäuse: | Schmiedestahl<br>Edelstahl AISI 316L<br>Duplex Stahl F51 |
| Membran: | nach Medium |
| Gasanschluss: | 5/8"UNF Variante 1 |
| Anstrich: | Rostschütz (allein Schmiedestahl) |
| Abnahme: | Auf Anfrage |

Società Accumulatori
Idropneumatici
Via Adige 10 12 14
Opera [Mi]

# MANUAL FOR USE AND MAINTENANCE EQUIPMENT TYPE L - LAV - AMP

Created : Olivari
Approved : Zanardi G.
Date 25-03-02
Page 1 of 4

**FOR YOUR SAFETY**

- This paragraph contains important info regarding safety. Read with attention before using the equipment
- In this document we define equipment (accumulator) the combination of shell,diaphragm and gasvalve.

**- Warnings and cautions**

**WARNINGS**: this symbol indicate warnings to be read before use of the product to prevent eventual physical damage to the user.

**CAUTIONS:** this symbol indicates procedures to prevent damage to the product.

**WARNINGS**

- To avoid risks of explosion or fire, do not expose the equipment to direct or indirect sources of heat.

- It is strictly forbidden to make structural modifications to the equipment (Welding or drilling for installation).

- ***Use ONLY NITROGEN, never other gases, DANGER OF EXPLOSION***

**CAUTIONS**

- Never exceed the maximum pressure stamped on the equipment
- Use grease, type Castrol 8794 or similar for diaphragms : NBR-HNBR-NBR for low temperatures - VITON
- Use oil type Caldic 47V350

**- INSTALLATION**

- Vertical or horizontal position, according to the needs of the plant it is strictly forbidden to install the equipment upside down, with the gasvalve downwards.
- When subject to vibration we advise to fix the equipment with the fasteners available on our catalogue.

- Some advice :
- Use in your system :
  - ➢ A check-valve between pump and accumulator
  - ➢ a limit valve, set under the max pressure indicated on the equipment
  - ➢ a safetyblock, in order to exclude the equipment from the system and to discharge the accumulator safety.

**- If the equipment is precharged, the operator must proceed as follows :**

1. Check the type of gasvalve 5/8"(with non return valve) or connection M28 x 1,5 (with internal allenscrew) Screw on the correct pressure checking and filling device on the accumulator.
2. open slowly the gasvalve of the equipment (follow the instructions of the operating manual of the device). The pressure gauge of the device will indicate the actual precharge pressure in the equipment. *N.B.: the precharge pressure is stamped on the body of the accumulator. (see page 2 the example of the stamping of the equipment).*
   a. If necessary to increase the precharge pressure go on as follows :
   b. Ensure that the discharge valve of the device is closed.
   c. Close the gasvalve of the accumulator with the device.
   d. Connect with the pressure hose the checking-and filling device with the nitrogen bottle.
   e. Verify that the pressure in the nitrogen bottle is higher than the required precharge pressure.
   f. Verify that the gasbottle has a pressure reducer.
   g. Open the bottle.
   h. Open slowly the gasvalve and let the nitrogen slowly inflate the accumulator.
   i. After reaching the pressure desired, close the gasvalve and let the pressure stabilise inside the accumulator for a short period of time.
   - *N.B.: the time necessary to stabilise the pressure depends of the volume of the equipment. Make a check after some minutes and repeat, if necessary, the operation.*

Valvola 5/8" UNF

**STRIPPING DOWN THE ACCUMULATOR OF THE PLANT AND ITS MAINTENANCE**

**WARNING**

**These operations have to be carried out by expertised people, because if not performed correctly, they may compromise the correct functionning of the equipment**

- For technical informations and/or quotations contact Tel. +39-02-57603913 Fax +39-02-57604752 or E-mail saip@saip.it The person in charge is Sergio Zanardi
- With normal operation and respecting the parmeters shown on the equipment this intervention will not necessitate.

If the customer will do the maintenance in his own shop he has to take following precautions :

1. Make sure all the valves are in discharge position and the pumps are stopped. Make sure no pressure has been left at the liquid side.
2. Make sure no pressure has been left at the gasside. Verify this with the checking device, Open the gasvalve to permit the gas in the accumulator to evacuate.
3. Strip down the accumulator from the plant.
4. Screw out the gasvalve with care and screw of the upper part of the accu with a bandkey, take out the diaphragm.

## STEPS TO REASSEMBLE EQUIPMENT L and LAV 0,1 and 0,35 litres :

1. Clean with care the inside of the components with compressed air. Make a visual check to make sure everything is cleaned well.
2. Replace the diaphragm with a new, original one. Lubrificate the outside of the diaphragm .
3. Lubrificate the seat of the diaphragm on the upper part of the accumulator.
4. Introduce the diaphragm in its seat. The operator must check the correct position of the seal-lip into its housing.
5. Screw manually the upper part of the accumulator on the lower part until the contact with the diaphragm increases the friction.
6. Terminate the closure of the equipment with the band-key until arriving at the torque value given on the end of this page.
7. Refix the gasvalve adding a joint of type OR2050 NBR. The torque value is indicated at the bottom of this page.
8. Actuate the precharging following the instructions of the manual of the device DP200.

## STEPS TO REASSEMBLE EQUIPMENT LAV 0,5 / 0,75 and AMP 0,5 litres :

1. Clean with care the inside of the component with compressed air. Make a visual check to make sure everything is cleaned well.
2. [Only for LAV 0,75] lubrificate the seat of the joint on the upper part, put the diaphragm in position and lubrificate another time also the joint.
3. Replace the diaphragm with a new, original one and lubrificate it on the outside.
4. [Only for LAV 0,75] Position the ring, seat of the diaphragm.
5. Place the diaphragm. The operator must check that the seal-lip will be fixed correct in the housing.
6. [Only for LAV 0,75] Insert the metal fixing ring over the diaphragm and lubrificate.
7. Screw together the upper and the lower part by hand until the friction starts to increase due to the contact with the diaphragm.
8. Terminate the closure of the equipment with the band-key until arriving at the torque value given at the bottom of this page.
9. Refit the gasvalve adding a joint of type OR2050 NBR. The torque is indicated at the bottom of this page.
10. Actuate the precharging following the instructions of the manual of the device DP200.

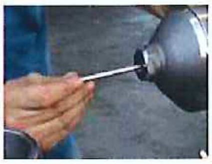
*N.B:: During the precharging it is necessary to fit the accumulator into a vise on a bench.*

## STEPS TO REASSEMBLE EQUIPMENT LAV from 1,5 up to 15 litres :

1. Clean with care the inside of the components with compressed air. Make a visual check to make sure everything is cleaned well.
2. Place the joint between the lower cap and the pipe.
3. Replace the diaphragm with a new,original one lubrificate it on the outside. .
4. Screw the lower cap together with the pipe maintaining the diaphragm in its seat upside.
5. Position the ring, seat of the diaphragm
6. Place the diaphragm. The operator must check that the seal-lip will be filtted correct in the housing.
7. Insert the metal ring over the diaphragm and lubricate the part that will be in contact with the diaphragm [for volumes 1,5 and 2,5]
8. Position the joint between pipe and upper cap and lubricate with care.
9. Screw by hand the upper cap on the pipe until the contact with the diaphragm will increase the friction.
10. Terminate the closure of the equipment using a band-key until arriving at the torque given at the bottom of this page.
11. Refit the gasvalve adding a joint of type OR2050 NBR. The torque is indicated at the bottom of this page.
12. Actuate the precharging following the instructions of the manual of the device type DP200.

*N.B.: During the precharging it is necessary to fit the accumulator into a vise on a bench.*

- ☐ For accumulators of type LAV 2,5 it is necessary to observe following instructions during the start-up of the precharging with nitrogen.
- ☐ It is important to guide the antiextrusion disk into the correct position.
- ☐ The operator must use a pin of 4 mm. dia. And 250 mm lenght.
- ☐ Introducing this pin from the liquid port into the small hole at the centre of the disk before starting the precharge. Now open slowly the gasbottle and guide with the pin the diaphragm at the centre of the oilport.This way also the disk will be in the correct position for functioning and in this way the anti-extrusion disk will event the rubber of the diaphragm to come in contact with the edge of the oilport, which might cause rupture of the bladder itself.



## TORQUE VALUE FOR THE END-CAPS

| | | |
|---|---|---|
| **L LAV 0,1-0,35** | **69,9** | **Nm** |
| **LAV AMP 0,5** | **69,9** | **Nm** |
| **LAV 0,75-1,5-2,5** | **109,6** | **Nm** |
| **LAV 4 and more** | **356** | **Nm** |

## TORQUE VALUE FOR THE GASVALVE

| | | |
|---|---|---|
| **Thread M12** | **59,73** | **Nm** |
| **Screw M8** | **40** | **Nm** |

## EXAMPLE OF MARKING THE EQUIPMENT

Ps.xxx Po xxx CE xxxx
01/02 L xxx T-xx +xx°C
Equipment xxx x xx x x x x

Legenda

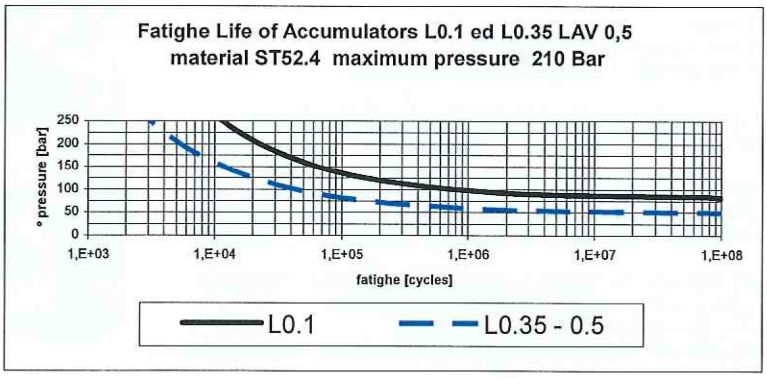
| | |
|---|---|
| Ps | Maximum pressure |
| Po | Precharge pressure |
| CE | Number of Notified Body |
| 01 | Month of construction |
| 02 | Year of construction |
| L | Volume in litres |
| T | Delta of operating temperature |
| Equipment | Type of equipment |

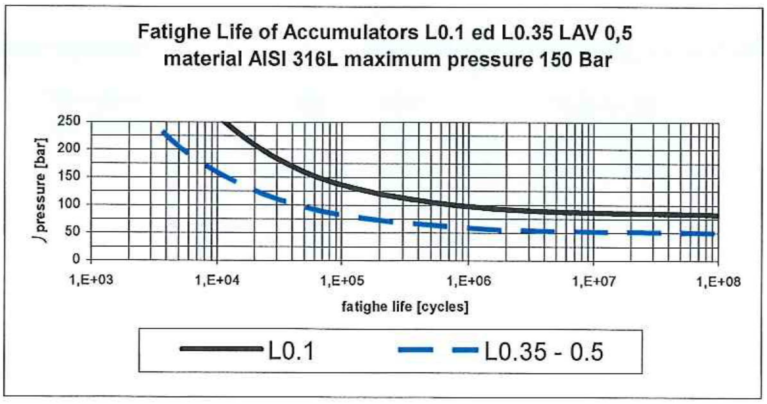
n.b.: The CE mark and the number of the notified body are stamped for equipment in Class II III IV

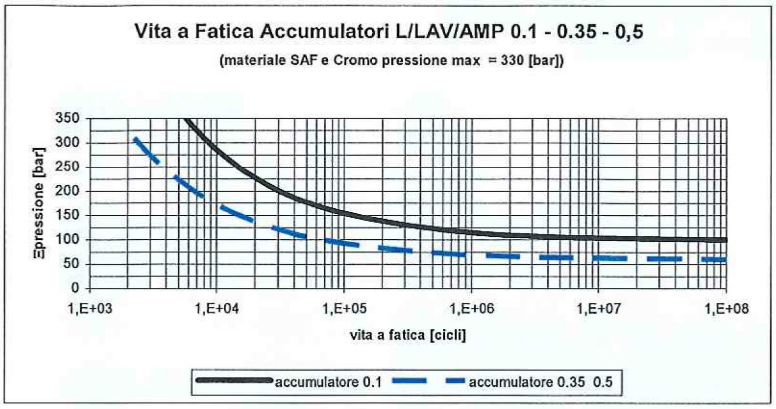
**WARNING**

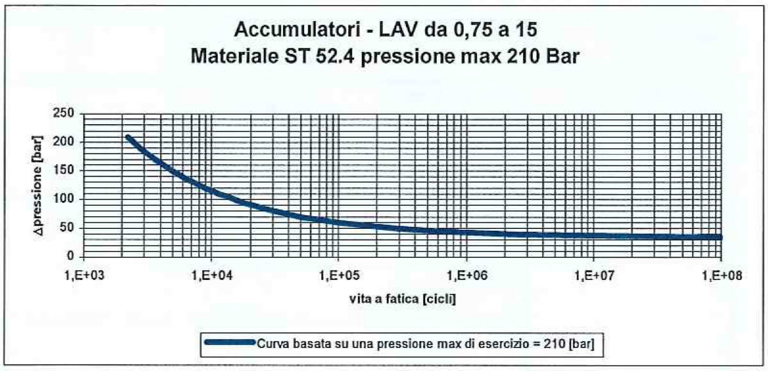
**Waste oils are toxic, and has to be treated according to the national laws regarding toxic waste.**

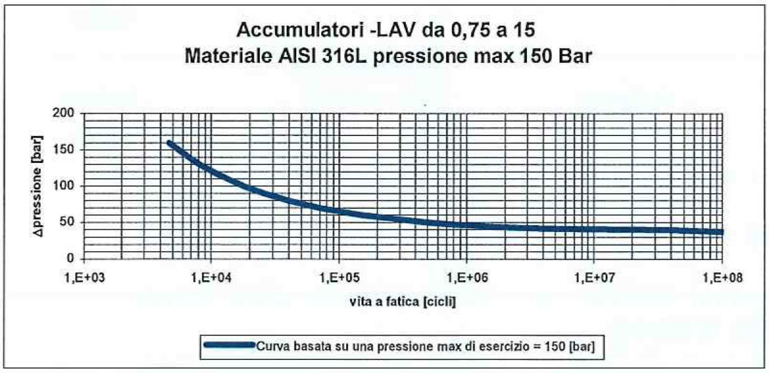
- The mechanical parts of the equipment are not subject to special rules.

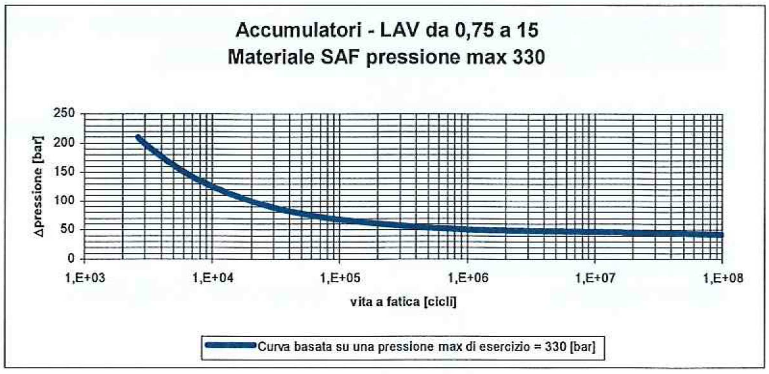

**Fatighe Life of Accumulators L0.1 ed L0.35 LAV 0,5 material ST52.4 maximum pressure 210 Bar**


**Fatighe Life of Accumulators L0.1 ed L0.35 LAV 0,5 material AISI 316L maximum pressure 150 Bar**


Vita a Fatica Accumulatori L/LAV/AMP 0.1 - 0.35 - 0,5
(materiale SAF e Cromo pressione max = 330 [bar])


Accumulatori - LAV da 0,75 a 15
Materiale ST 52.4 pressione max 210 Bar


Accumulatori -LAV da 0,75 a 15
Materiale AISI 316L pressione max 150 Bar


Accumulatori - LAV da 0,75 a 15
Materiale SAF pressione max 330

N.B.: The directive defines the value of > **$2*10^6$** to be the Endurance Limit of the equipment

N.B.: When the pressure values would go over the Endurance Limit shown in the diaphragm verify that the equipment will not go over the cycles shown in the diaphragm.

# Abnahmeprüfzeugnis 3.1 EN 10204-3.1
## Inspection certificate 3.1 EN 10204-3.1

SPECK

**Hersteller:**
Manufacturer:

**SPECK-KOLBENPUMPENFABRIK**
**Otto Speck GmbH & Co.KG**
**82538 Geretsried**

**Hochdruckpumpenaggregat:**
High-pressure power unit:

**Nr.**
No. **600911/01**

**Pumpentyp:**
Pump model:

**Nr.**
No. **600911/01/01**
**600911/01/02**

**Motordaten:**
Motor data:

**250S/M-04 SN1028201195**
**55kW 380/660 V D/Y 50Hz 108/62,0 A 1475 1/min**

| **Meßwerte**<br>Measured values<br>in Anlehnung an VDMA24284 ermittelt<br>determined in acc. with VDAM24284 | | **Soll**<br>specified | **Ist**<br>actual | | **Soll**<br>specified | **Ist**<br>actual |
|---|---|---|---|---|---|---|
| | **Förderstrom**<br>Output<br>**Q** (l/h) | **16080**<br>**±804** | **17200** | **Betriebsdruck**<br>Operating pressure<br>$p_d$ (bar) | **80** | **80** |
| | **Stromaufnahme**<br>Current<br>**I** (A) | **< 108** | **77,0** | **Pumpendrehzahl**<br>Pump revolutions<br>**n** (1/min) | **800** | **848** |
| | | | | **Ölleckage**<br>Oil leakage | | **keine**<br>none |
| | **Fördermedium**<br>Fluid medium | | **Wasser**<br>water | **Wasserleckage**<br>Water leakage | | **keine**<br>none |
| | **Vorspannung Druckspeicher**<br>Precharge press. accum. (bar) | **48** | **48** | | | |
| angeschlossene Versorgungsspannung:<br>connected voltage: | **400 V 50 Hz** | | | | | |

Die angegebenen Werte sind Ist-Werte. Es wird bestätigt, dass die Lieferung geprüft wurde und den Vereinbarungen bei der Bestellannahme entspricht.

The listed values are actual values. We confirm that the consignment has been inspected and corresponds with the conditions of the accept order.

Werkssachverständiger:
Works authority: Geretsried, 17.06.2015

i.V. Th. Messerschmied

**(i.V. Th.Messerschmied, QSB)**

# **Abnahmeprüfzeugnis 3.1** **EN 10204-3.1**
# Inspection certificate 3.1 EN 10204-3.1

SPECK

**Hersteller:**
Manufacturer:

**SPECK-KOLBENPUMPENFABRIK**
**Otto Speck GmbH & Co.KG**
**82538 Geretsried**

**Hochdruckpumpenaggregat:**
High-pressure power unit:

**Nr.**
No.
**600911/02**

**Pumpentyp:**
Pump model:

**Nr.**
No.
**600911/02/01**
**600911/02/02**

**Motordaten:**
Motor data:

**250S/M-04 SN1028201194**
**55kW 380/660 V D/Y 50Hz 108/62,0 A 1475 1/min**

| **Meßwerte**<br>Measured values<br>in Anlehnung an VDMA24284 ermittelt<br>determined in acc. with VDAM24284 | | **Soll**<br>specified | **Ist**<br>actual | | **Soll**<br>specified | **Ist**<br>actual |
|---|---|---|---|---|---|---|
| | **Förderstrom**<br>Output<br>Q (l/h) | **16080**<br>**±804** | **17200** | **Betriebsdruck**<br>Operating pressure<br>$p_d$ (bar) | **80** | **80** |
| | **Stromaufnahme**<br>Current<br>I (A) | **< 108** | **80,0** | **Pumpendrehzahl**<br>Pump revolutions<br>n (1/min) | **800** | **848** |
| | | | | **Ölleckage**<br>Oil leakage | | **keine**<br>none |
| | **Fördermedium**<br>Fluid medium | | **Wasser**<br>water | **Wasserleckage**<br>Water leakage | | **keine**<br>none |
| | **Vorspannung Druckspeicher**<br>Precharge press. accum. (bar) | **48** | **48** | | | |
| angeschlossene Versorgungsspannung:<br>connected voltage: | | **400 V 50 Hz** | | | | |

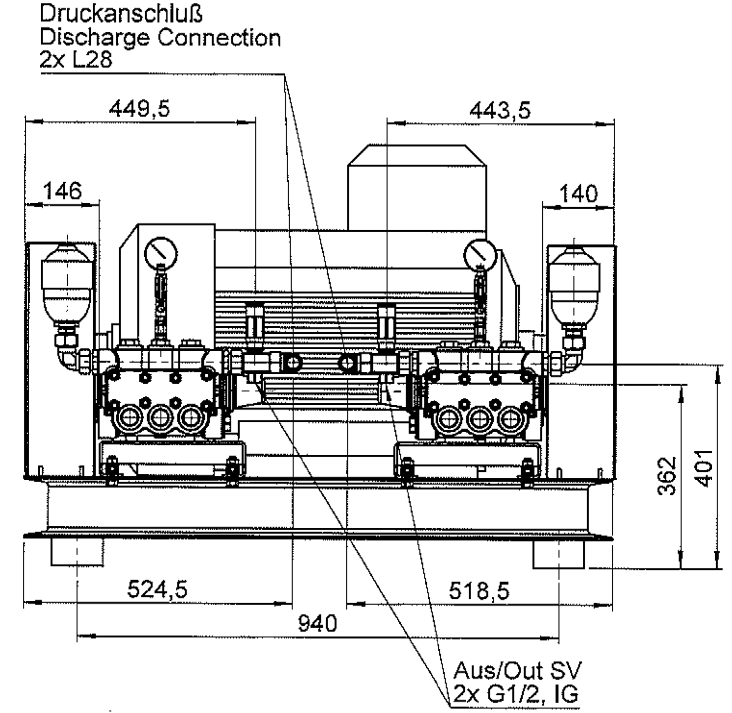
Die angegebenen Werte sind Ist-Werte. Es wird bestätigt, dass die Lieferung geprüft wurde und den Vereinbarungen bei der Bestellannahme entspricht.

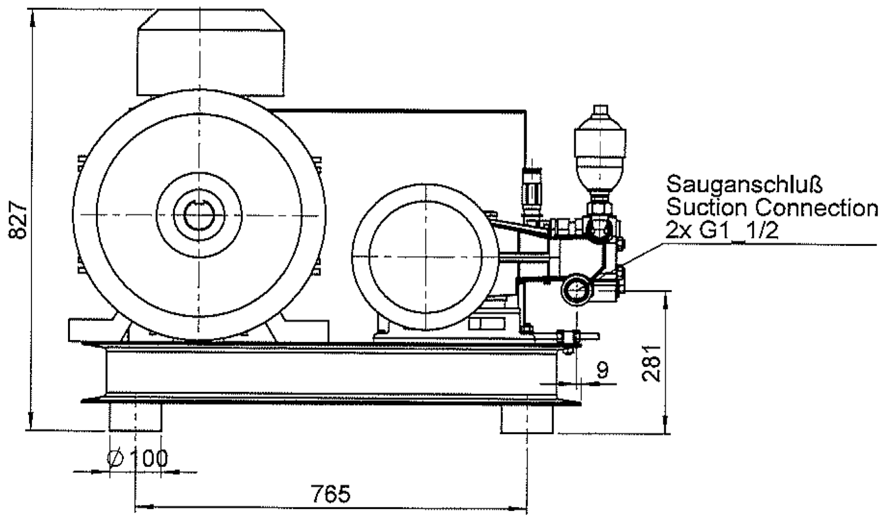
The listed values are actual values. We confirm that the consignment has been inspected and corresponds with the conditions of the accept order.

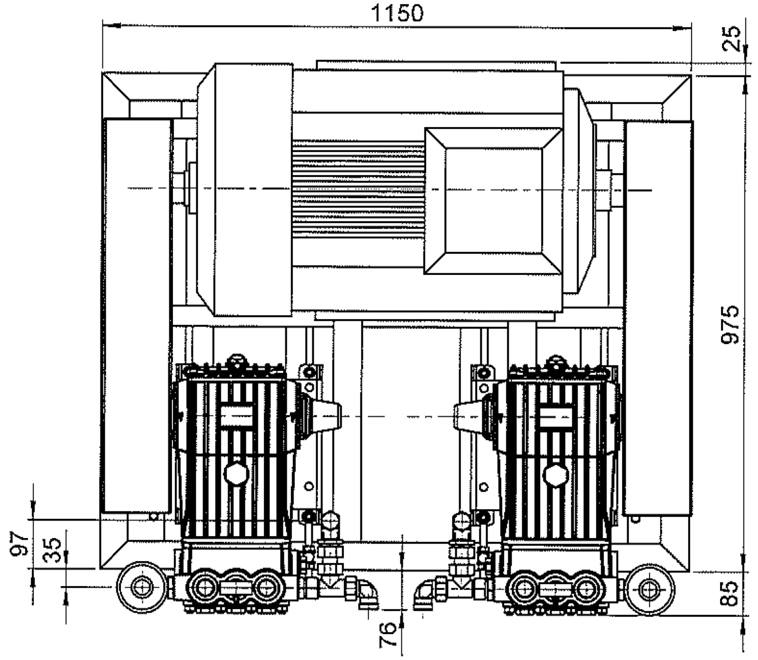
Werkssachverständiger:
Works authority:

Geretsried, 17.06.2015

i.V. Th. Messerschmied
**(i.V. Th.Messerschmied, QSB)**







Ausgabe vom 29.04.2015

Diese Zeichnung darf ohne unsere Genehmigung weder dritten Personen noch Konkurenzfirmen mitgeteilt werden. (Gesetz vom 19.06.1961 betr. das Urheberrecht).

Alle Rechte vorbehalten

Aufgrund vorab nicht eindeutig definierbarer Positionen der Schraub- und Schweißverbindungen der hydraulischen Anbindung muß mit Abweichungen der hier angegebenen Anschlußmaße gerechnet werden. Die Einbaumaße sind zudem ggf. abhängig von der Riemenspannung.

Issue date 29.04.2015

This drawing must not be given to third parties or competitor companies without our approval. Copyright law from 19.06.1961.

All rights reserved

Because the hydraulic screw and weld positions are initially not clearly definable, discrepancies regarding the indicated connection dimensions must be taken into account. The fitting dimensions depend largely on the belt tension.

| Tolerierung ISO 8015 | | Allgemeintoleranz DIN ISO 2768-mK | | |
|---|---|---|---|---|
| 1 bis 6 | über 6 bis 30 | über 30 bis 100 | über 100 bis 300 | über 300 bis 1000 |
| ±0.1 | ±0.2 | ±0.3 | ±0.5 | ±0.8 |

| | Datum | Name |
|---|---|---|
| Bearb. | 22.01.15 | Schurek |
| Gepr. | | |

| Aus-gabe | Änderung | Tag | Name |
|---|---|---|---|

Werkstoff-Lieferzustand

Abmessung DIN

Werkstoff-Endzustand

Modell-, Gesenk-Nr. Speck Belgien Gewicht/kg 946,960 kg

## Aggregat P51/135-90

Bgr. 250S+M, VS200/180, VS450/200, DS, Doppelaggregat

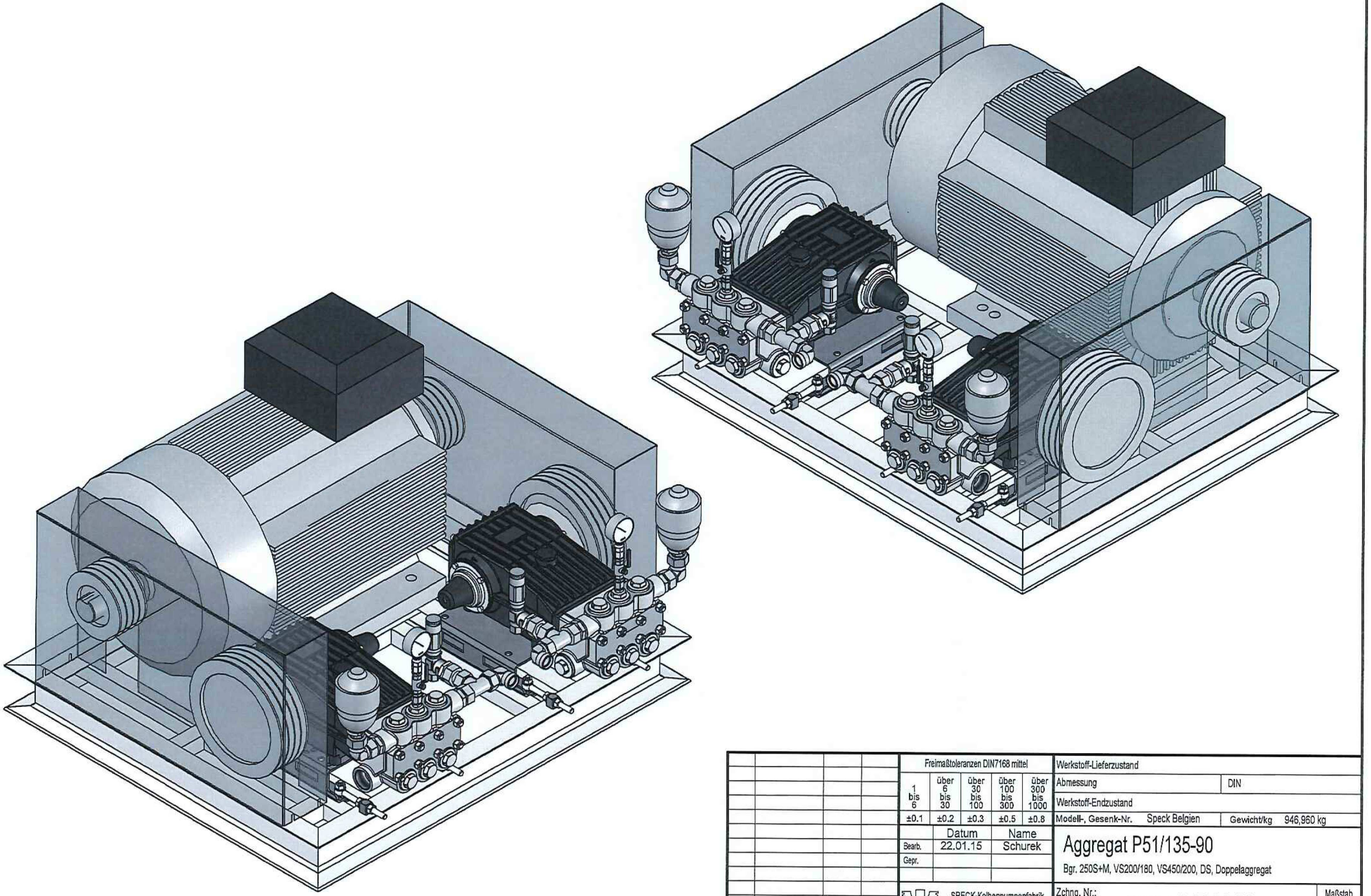
SPECK-Kolbenpumpenfabrik
Otto Speck GmbH & Co. KG
D-82523 Geretsried

Zchng. Nr.: agg_ab600911

Maßstab 1:10

Ers. für:

Kurzbez. ab600911



| Aus-gabe | Änderung | Tag | Name |
|---|---|---|---|
| | | | |

Freimaßtoleranzen DIN7168 mittel

| 1 bis 6 | über 6 bis 30 | über 30 bis 100 | über 100 bis 300 | über 300 bis 1000 |
|---|---|---|---|---|
| ±0.1 | ±0.2 | ±0.3 | ±0.5 | ±0.8 |

| | Datum | Name |
|---|---|---|
| Bearb. | 22.01.15 | Schurek |
| Gepr. | | |

SPECK-Kolbenpumpenfabrik
Otto Speck GmbH & Co. KG
D-82523 Geretsried

| | | | |
|---|---|---|---|
| Werkstoff-Lieferzustand | | | |
| Abmessung | | DIN | |
| Werkstoff-Endzustand | | | |
| Modell-, Gesenk-Nr. | Speck Belgien | Gewicht/kg | 946,960 kg |

Aggregat P51/135-90

Bgr. 250S+M, VS200/180, VS450/200, DS, Doppelaggregat

| Zchng. Nr.: | Maßstab |
|---|---|
| agg_ab600911 | 1:7,5 |
| Ers. für: | Kurzbez. ab600911 |

SPECK

# Erklärung für den Einbau einer unvollständigen Maschine
gemäß EG-Richtlinie 2006/42/EG über Maschinen

# Declaration of incorporation of partly completed machinery
according to EC directive 2006/42/EC on machinery

# Déclaration d'incorporation de quasi-machines
conformément à la directive européenne 2006/42/CE relative aux machines

**Hersteller:**
Manufacturer:
Fabricant:

**SPECK-KOLBENPUMPENFABRIK**
**Otto Speck GmbH & Co.KG**
**82538 Geretsried**

**Hiermit erklären wir, dass folgendes Produkt:**
We herewith declare that the product described below:
Par ceci nous déclarons que le produit suivant:

**Hochdruckpumpenaggregat**
High-pressure power unit
L'agrégat de pompe haute pression

**Serien-Nummer:**
Serial number: **600911**
Numéro de série:

**Pumpentyp:**
Pump model: **P51/135-90**
Type de pompe:

**Baujahr:**
Year of manufacture: **06/2015**
Année de fabrication:

**den folgenden grundlegenden Anforderungen der Richtlinie 2006/42/EG entspricht:**
complies with the following essential requirements as defined in directive 2006/42/EC:
est conforme aux exigences essentielles conformément à la directive 2006/42/CE suivantes

**Anhang I, Artikel**
Annex I, Article
Annexe I, Article

**1.1.3. / 1.1.5. / 1.3.1. / 1.3.2. / 1.3.3. / 1.3.4. / 1.3.8.1. / 1.4.1. / 1.4.2.1. /**

**Die speziellen technischen Unterlagen nach Anhang VII Teil B wurden erstellt.**
The relevant technical documentation is compiled in accordance with part B of Annex VII.
La documentation technique pertinente est constituée conformément à l'annexe VII, partie B.

**Die unvollständige Maschine darf nicht in Betrieb genommen werden, bis festgestellt wurde, dass die Maschine, in die die unvollständige Maschine eingebaut werden soll, den Bestimmungen der Richtlinie (2006/42/EG) über Maschinen entspricht.**
The partly completed machine must not to be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of the EC directive 2006/42/EC on machinery.
La quasi-machine ne doit pas être mise en service avant que la machine finale dans laquelle elle doit être incorporée ait été déclarée conforme à la directive européenne 2006/42/CE relative aux machines.

**Angewendete Normen:**
Applied standards:
Normes appliqués:

**EN ISO 12100:2010**
**DIN EN 60204-1**
**DIN EN 809**

**Der Hersteller verpflichtet sich, auf begründetes Verlangen die speziellen Unterlagen zur unvollständigen Maschine einzelstaatlichen Stellen auf Verlangen elektronisch zu übermitteln.**
The manufacturer undertake to transmit, in response to a reasoned request by the national authorities, relevant information on the partly completed machinery by telecommunication channels.
Le fabricant s'engage de transmettre, à la suite d'une demande dûment motivée des autorités nationales, les informations pertinentes concernant la quasi-machine par le courrier électronique.

**Bevollmächtigter für die Zusammenstellung der relevanten Dokumentation:**
Person authorised to compile the relevant technical documentation:
Personne autorisée à constituer le dossier technique important:

**H. Dörn**
**Tel.+49(0)8171/6293-56**

Geretsried, 01.06.2015

**i.V. W. Dörn**
**Speck-Triplex-Pumpen**

i.V. Th. Messerschmied

**i.V. Th. Messerschmied**
**Speck-Kolbenpumpenfabrik**
**QS-Beauftragter** QA Representativ
Responsable d'assurance de la qualité

Motors | Automation | Energy | Transmission & Distribution | Coatings

# Manual Geral de Instalação, Operação e Manutenção de Motores Elétricos

# Installation, Operation and Maintenance Manual of Electric Motors

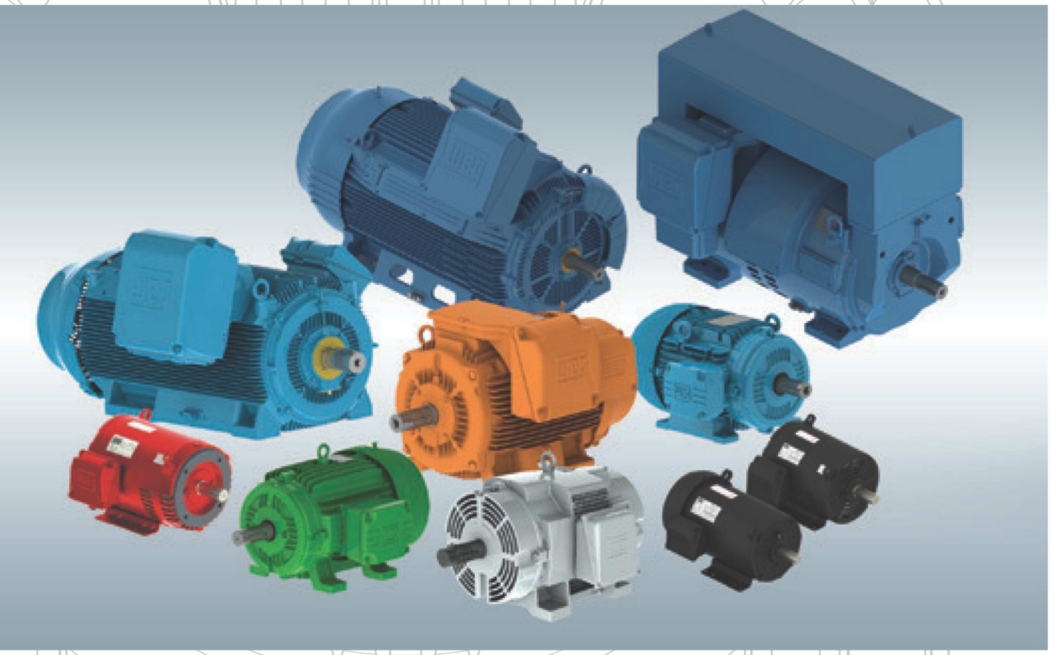
# Manual General de Instalación, Operación y Mantenimiento de Motores Eléctricos

# Installations-, Betriebs- und Wartungsanleitung für Elektrische Motoren

# Manual de Instalare, Exploatare şi Întreţinere a Motoarelor Electrice

# Ръководство за монтаж, експлоатация и поддръжка на електродвигатели

# Руководство по установке, эксплуатации и техническому обслуживанию электрических двигателей



Português 2

English 59

Español 115

Deutsch 173

Română 231

Български 287

Русский 342

# INSTALLATION, OPERATION AND MAINTENANCE MANUAL OF ELECTRIC MOTORS

This manual provides information about WEG induction motors fitted with squirrel cage, permanent magnet or hybrid rotors, low, medium and high voltage, in frame sizes IEC 56 to 630 and NEMA 42 to 9606/10.
The motor lines indicated below have additional information that can be checked in their respective manuals:

- Smoke Extraction Motors;
- Electromagnetic Brake Motors;
- Hazardous Area Motors.

These motors meet the following standards, if applicable:

- NBR 17094-1: Máquinas Elétricas Girantes - Motores de Indução - Parte 1: trifásicos.
- NBR 17094-2: Máquinas Elétricas Girantes - Motores de Indução - Parte 2: monofásicos.
- IEC 60034-1: Rotating Electrical Machines - Part 1: Rating and Performance.
- NEMA MG 1: Motors and Generators.
- CSA C 22.2 N°100: Motors and Generators.
- UL 1004-1: Rotating Electrical Machines - General Requirements.

If you have any questions regarding this manual please contact your local WEG branch, contact details can be found at www.weg.net.

## TABLE OF CONTENTS

**1. TERMINOLOGY 63**

**2. INITIAL RECOMMENDATIONS 64**

2.1. WARNING SYMBOL ........ 64
2.2. RECEIVING INSPECTION ........ 64
2.3. NAMEPLATES ........ 65

**3. SAFETY INSTRUCTIONS 68**

**4. HANDLING AND TRANSPORT 69**

4.1. LIFTING ........ 69
  4.1.1. Horizontal motors with one eyebolt ........ 69
  4.1.2. Horizontal motor with two eyebolts ........ 70
  4.1.3. Vertical motors ........ 71
  4.1.3.1. Procedures to place W22 motors in the vertical position ........ 71
  4.1.3.2. Procedures to place HGF motors in the vertical position ........ 72
  4.2 Procedures to place W22 vertical mount motors in horizontal position ........ 74

**5. STORAGE 75**

5.1. EXPOSED MACHINED SURFACES ........ 75
5.2. STORAGE ........ 75
5.3 BEARINGS ........ 76
  5.3.1 Grease lubricated bearings ........ 76
  5.3.2 Oil lubricated bearings ........ 76
  5.3.3 Oil Mist lubricated bearings ........ 77
  5.3.4 Sleeve bearing ........ 77
5.4. INSULATION RESISTANCE ........ 77
  5.4.1. Insulation resistance measurement ........ 77

**6. INSTALLATION 80**

6.1. FOUNDATIONS ........ 81
6.2. MOTOR MOUNTING ........ 82
  6.2.1. Foot mounted motors ........ 82
  6.2.2. Flange mounted motors ........ 82
  6.2.3. Pad mounted motors ........ 83
6.3. BALANCING ........ 83
6.4. COUPLINGS ........ 83
  6.4.1. Direct coupling ........ 84
  6.4.2. Gearbox coupling ........ 84
  6.4.3. Pulley and belt coupling ........ 84
  6.4.4. Coupling of sleeve bearing motors ........ 84
6.5. LEVELING ........ 86

6.6. ALIGNMENT ........ 86
6.7. CONNECTION OF OIL LUBRICATED OR OIL MIST LUBRICATED MOTORS ........ 87
6.8. CONNECTION OF THE COOLING WATER SYSTEM ........ 87
6.9. ELECTRICAL CONNECTION ........ 87
6.10. CONNECTION OF THE THERMAL PROTECTION DEVICES ........ 90
6.11. RESISTANCE TEMPERATURE DETECTORS (PT-100) ........ 91
6.12. CONNECTION OF THE SPACE HEATERS ........ 93
6.13. STARTING METHODS ........ 94
6.14. MOTORS DRIVEN BY FREQUENCY INVERTER ........ 95
    6.14.1. Use of dV/dt filter ........ 95
    6.14.1.1. Motor with enameled round wire ........ 95
    6.14.1.2. Motor with prewound coils ........ 95
    6.14.2. Bearing insulation ........ 96
    6.14.3. Switching frequency ........ 96
    6.14.4. Mechanical speed limitation ........ 96

7. COMMISSIONING 97

7.1. INITIAL START-UP ........ 97
7.2. OPERATING CONDITIONS ........ 99
    7.2.1.Limits of vibration ........ 100

8. MAINTENANCE 101

8.1. GENERAL INSPECTION ........ 101
8.2. LUBRICATION ........ 101
    8.2.1. Grease lubricated rolling bearings ........ 102
    8.2.1.1. Motor without grease fitting ........ 105
    8.2.1.2. Motor with grease fitting ........ 105
    8.2.1.3. Compatibility of the Mobil Polyrex EM grease with other greases ........ 106
    8.2.2. Oil lubricated bearings ........ 106
    8.2.3. Oil mist lubricated bearings ........ 107
    8.2.4. Sleeve bearings ........ 107
8.3. MOTOR ASSEMBLY AND DISASSEMBLY ........ 108
    8.3.1. Terminal box ........ 109
8.4. DRYING THE STATOR WINDING INSULATION ........ 109
8.5. SPARE PARTS ........ 110

9. ENVIRONMENTAL INFORMATION 111

9.1. PACKAGING ........ 111
9.2. PRODUCT ........ 111

10. TROUBLESHOOTING CHART X SOLUTIONS 112

11. WARRANTY TERM 113

12. EC DECLARATION OF CONFORMITY 114

# 1. TERMINOLOGY

***Balancing:*** the procedure by which the mass distribution of a rotor is checked and, if necessary, adjusted to ensure that the residual unbalance or the vibration of the journals and/or forces on the bearings at a frequency corresponding to service speed are within specified limits in International Standards.
[ISO 1925:2001, definition 4.1]

***Balance quality grade:*** indicates the peak velocity amplitude of vibration, given in mm/s, of a rotor running free-in-space and it is the product of a specific unbalance and the angular velocity of the rotor at maximum operating speed.

***Grounded Part:*** metallic part connected to the grounding system.

***Live Part:*** conductor or conductive part intended to be energized in normal operation, including a neutral conductor.

***Authorized personnel:*** employee who has formal approval of the company.

***Qualified personnel:*** employee who meets the following conditions simultaneously:
- Receives training under the guidance and responsibility of a qualified and authorized professional;
- Works under the responsibility of a qualified and approved professional.

***Note****: The qualification is only valid for the company that trained the employee in the conditions set out by the authorized and qualified professional responsible for training.*

## 2. INITIAL RECOMMENDATIONS

Electric motors have energized circuits, exposed rotating parts and hot surfaces that may cause serious injury to people during normal operation. Therefore, it is recommended that transportation, storage, installation, operation and maintenance services are always performed by qualified personnel.
Also the applicable procedures and relevant standards of the country where the machine will be installed must be considered.
Noncompliance with the recommended procedures in this manual and other references on the WEG website may cause severe personal injuries and/or substantial property damage and may void the product warranty.

For practical reasons, it is not possible to include in this Manual detailed information that covers all construction variables nor covering all possible assembly, operation or maintenance alternatives.
This Manual contains only the required information that allows qualified and trained personnel to carry out their services. The product images are shown for illustrative purpose only.

For *Smoke Extraction Motors*, please refer to the additional instruction manual 50026367 available on the website www.weg.net.

For brake motors, please refer to the information contained in WEG 50021973 brake motor manual available on the website www.weg.net.

For information about permissible radial and axial shaft loads, please check the product technical catalogue.

The user is responsible for the correct definition of the installation environment and application characteristics.

During the warranty period, all repair, overhaul and reclamation services must be carried out by WEG authorized Service Centers to maintain validity of the warranty.

### 2.1. WARNING SYMBOL

Warning about safety and warranty.

### 2.2. RECEIVING INSPECTION

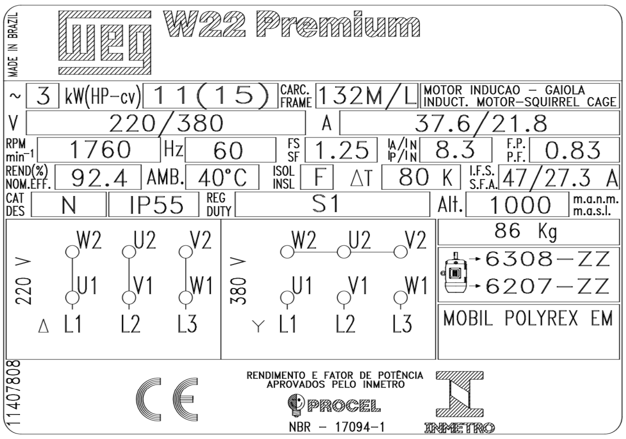
All motors are tested during the manufacturing process.
The motor must be checked when received for any damage that may have occurred during the transportation. All damages must be reported in writing to the transportation company, to the insurance company and to WEG. Failure to comply with such procedures will void the product warranty.
You must inspect the product:

- Check if nameplate data complies with the purchase order;
- Remove the shaft locking device (if any) and rotate the shaft by hand to ensure that it rotates freely;
- Check that the motor has not been exposed to excessive dust and moisture during the transportation.

Do not remove the protective grease from the shaft, or the plugs from the cable entries. These protections must remain in place until the installation has been completed.

## 2.3. NAMEPLATES

The nameplate contains information that describes the construction characteristics and the performance of the motor. Figure 2.1 and Figure 2.2 show nameplate layout examples.



MADE IN BRAZIL

W22 Premium

~ 3 kW(HP-cv) 11(15) CARC. FRAME 132M/L MOTOR INDUCAO – GAIOLA INDUCT. MOTOR–SQUIRREL CAGE

V 220/380 A 37.6/21.8

RPM min-1 1760 Hz 60 FS SF 1.25 IA/IN IP/IN 8.3 F.P. P.F. 0.83

REND(%) NOM.EFF. 92.4 AMB. 40°C ISOL INSL F ΔT 80 K I.F.S. S.F.A. 47/27.3 A

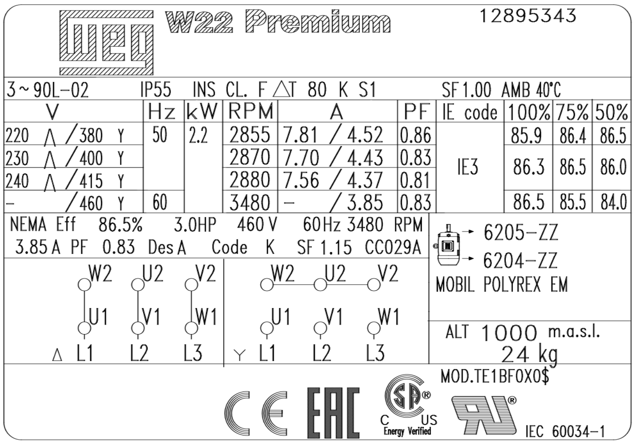
CAT DES N IP55 REG DUTY S1 Alt. 1000 m.a.n.m. m.a.s.l.

86 Kg

6308–ZZ
6207–ZZ
MOBIL POLYREX EM

11407808

RENDIMENTO E FATOR DE POTÊNCIA APROVADOS PELO INMETRO
PROCEL
NBR – 17094-1
INMETRO



W22 Premium 12895343

3~90L-02 IP55 INS CL. F ΔT 80 K S1 SF 1.00 AMB 40°C

| V | Hz | kW | RPM | A | PF | IE code | 100% | 75% | 50% |
|---|---|---|---|---|---|---|---|---|---|
| 220 Δ / 380 Y | 50 | 2.2 | 2855 | 7.81 / 4.52 | 0.86 | IE3 | 85.9 | 86.4 | 86.5 |
| 230 Δ / 400 Y | | | 2870 | 7.70 / 4.43 | 0.83 | | 86.3 | 86.5 | 86.0 |
| 240 Δ / 415 Y | | | 2880 | 7.56 / 4.37 | 0.81 | | | | |
| – / 460 Y | 60 | | 3480 | – / 3.85 | 0.83 | | 86.5 | 85.5 | 84.0 |

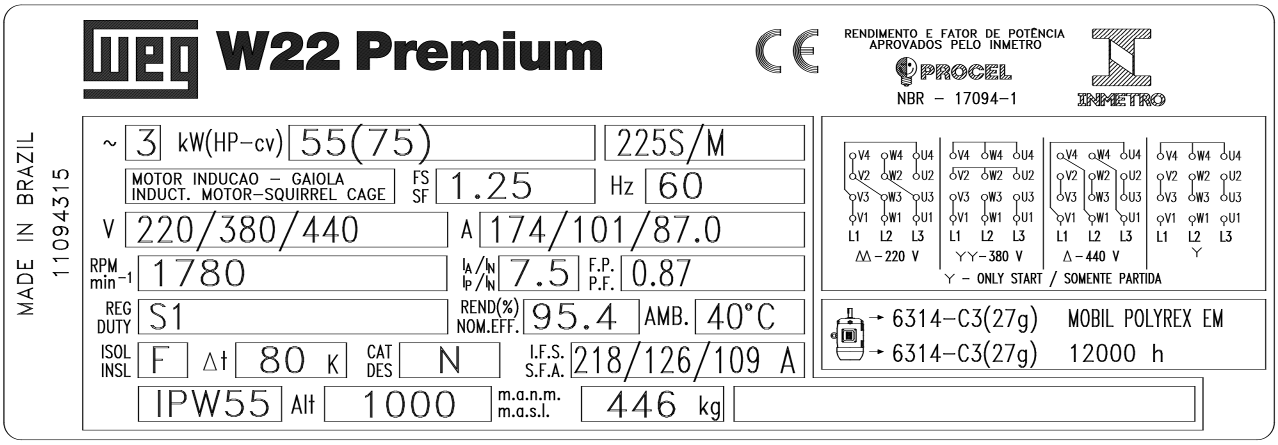
NEMA Eff 86.5% 3.0HP 460 V 60Hz 3480 RPM
3.85 A PF 0.83 Des A Code K SF 1.15 CC029A

6205–ZZ
6204–ZZ
MOBIL POLYREX EM

ALT 1000 m.a.s.l.
24 kg

MOD.TE1BF0X0$

IEC 60034-1



W22 Premium

RENDIMENTO E FATOR DE POTÊNCIA APROVADOS PELO INMETRO
PROCEL
NBR – 17094-1
INMETRO

MADE IN BRAZIL
11094315

~ 3 kW(HP-cv) 55(75) 225S/M

MOTOR INDUCAO – GAIOLA INDUCT. MOTOR–SQUIRREL CAGE FS SF 1.25 Hz 60

V 220/380/440 A 174/101/87.0

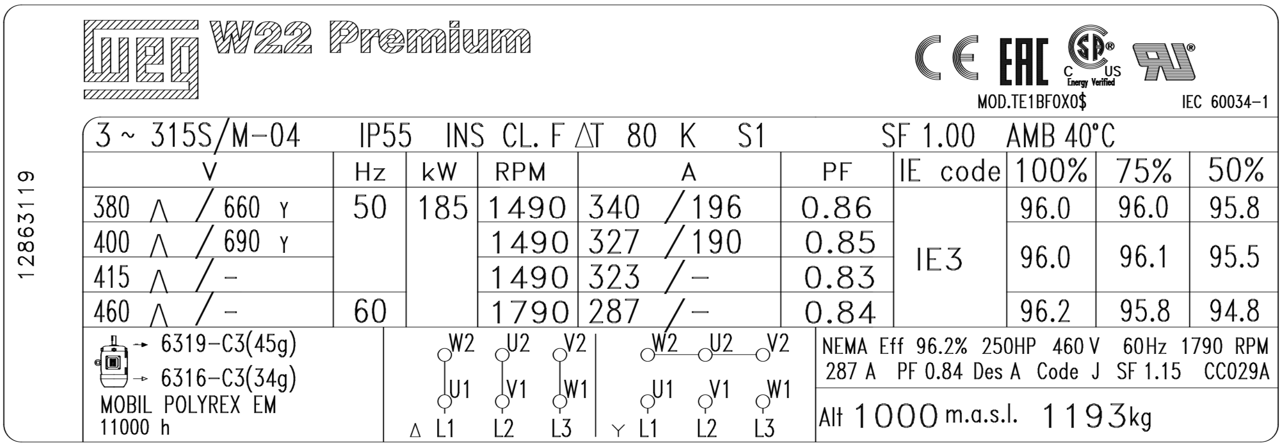
RPM min-1 1780 IA/IN IP/IN 7.5 F.P. P.F. 0.87

REG DUTY S1 REND(%) NOM.EFF. 95.4 AMB. 40°C

ISOL INSL F Δt 80 K CAT DES N I.F.S. S.F.A. 218/126/109 A

IPW55 Alt 1000 m.a.n.m. m.a.s.l. 446 kg

6314–C3(27g) MOBIL POLYREX EM
6314–C3(27g) 12000 h



W22 Premium

MOD.TE1BF0X0$ IEC 60034-1

12863119

3 ~ 315S/M-04 IP55 INS CL. F ΔT 80 K S1 SF 1.00 AMB 40°C

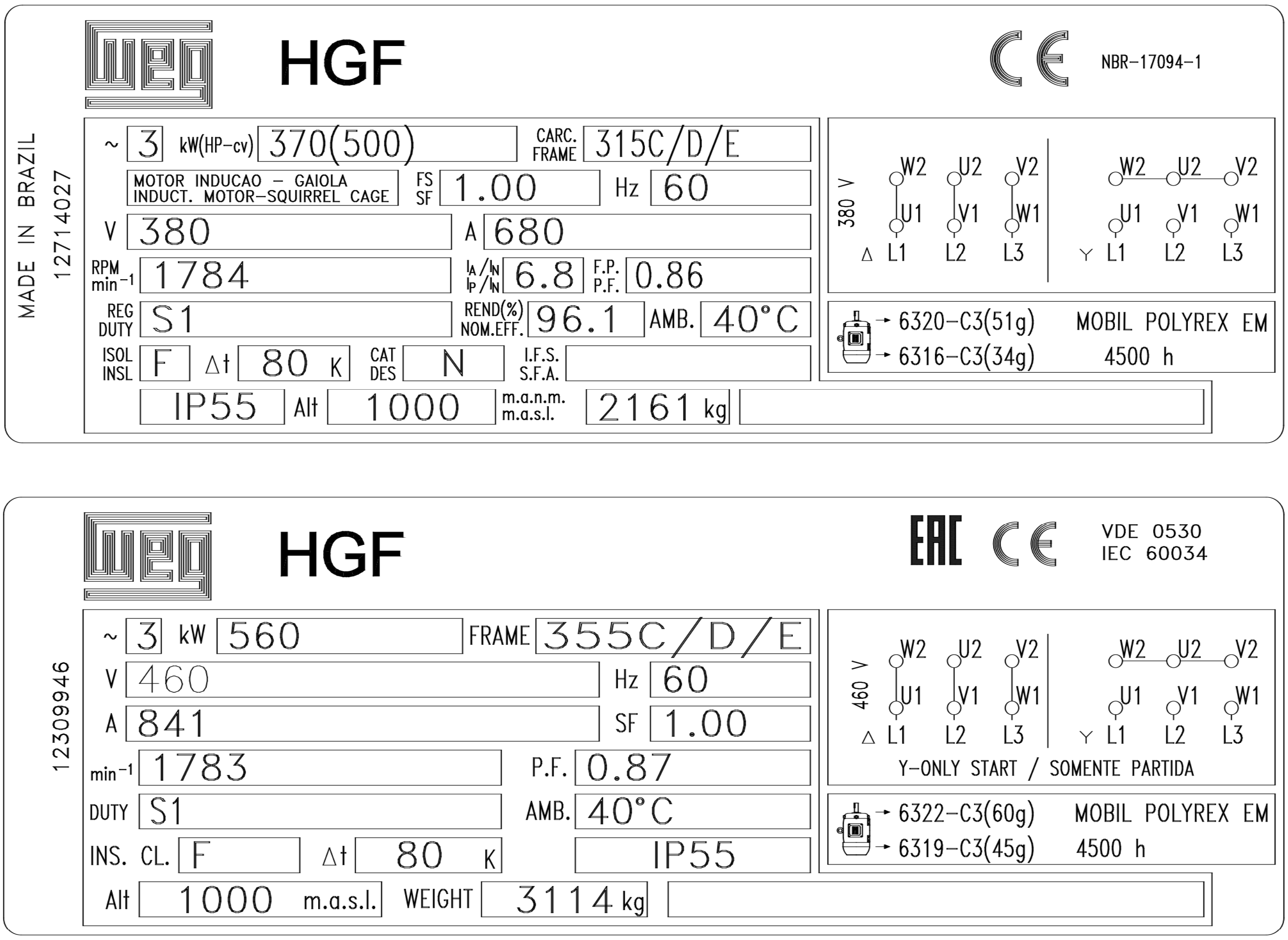
| V | Hz | kW | RPM | A | PF | IE code | 100% | 75% | 50% |
|---|---|---|---|---|---|---|---|---|---|
| 380 Δ / 660 Y | 50 | 185 | 1490 | 340 / 196 | 0.86 | IE3 | 96.0 | 96.0 | 95.8 |
| 400 Δ / 690 Y | | | 1490 | 327 / 190 | 0.85 | | 96.0 | 96.1 | 95.5 |
| 415 Δ / – | | | 1490 | 323 / – | 0.83 | | | | |
| 460 Δ / – | 60 | | 1790 | 287 / – | 0.84 | | 96.2 | 95.8 | 94.8 |

6319–C3(45g)
6316–C3(34g)
MOBIL POLYREX EM
11000 h

NEMA Eff 96.2% 250HP 460 V 60Hz 1790 RPM
287 A PF 0.84 Des A Code J SF 1.15 CC029A

Alt 1000 m.a.s.l. 1193kg

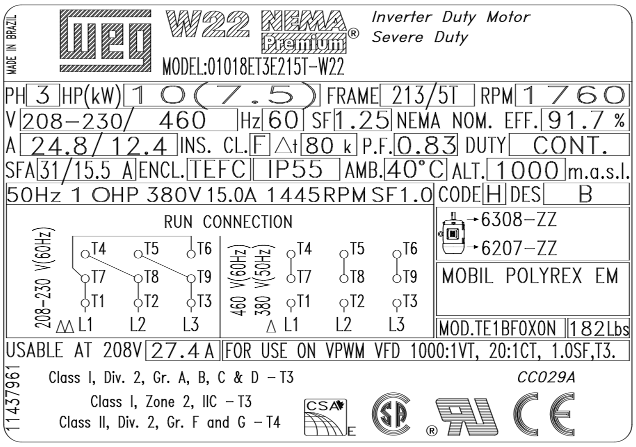
ENGLISH



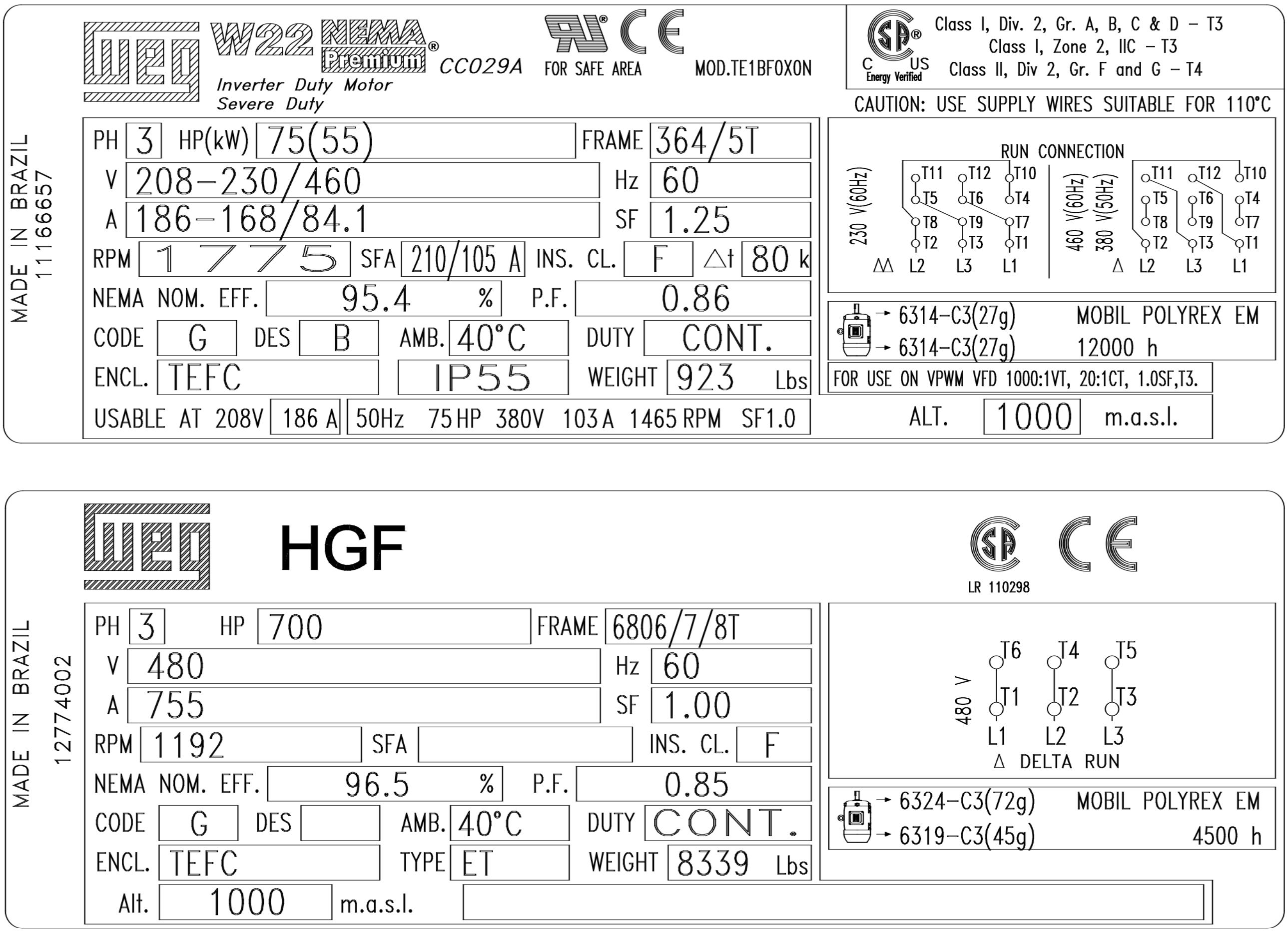
MADE IN BRAZIL
12714027
HGF
NBR-17094-1
~ 3 kW(HP-cv) 370(500) CARC. FRAME 315C/D/E
MOTOR INDUCAO - GAIOLA INDUCT. MOTOR-SQUIRREL CAGE FS SF 1.00 Hz 60
V 380 A 680
RPM min-1 1784 IA/IN IP/IN 6.8 F.P. P.F. 0.86
REG DUTY S1 REND(%) NOM.EFF. 96.1 AMB. 40°C
ISOL INSL F Δt 80 K CAT DES N I.F.S. S.F.A.
IP55 Alt 1000 m.a.n.m. m.a.s.l. 2161 kg
380 V
W2 U2 V2 U1 V1 W1 Δ L1 L2 L3
W2 U2 V2 U1 V1 W1 Y L1 L2 L3
6320-C3(51g) MOBIL POLYREX EM
6316-C3(34g) 4500 h

12309946
HGF
EAC
VDE 0530
IEC 60034
~ 3 kW 560 FRAME 355C/D/E
V 460 Hz 60
A 841 SF 1.00
min-1 1783 P.F. 0.87
DUTY S1 AMB. 40°C
INS. CL. F Δt 80 K IP55
Alt 1000 m.a.s.l. WEIGHT 3114 kg
460 V
W2 U2 V2 U1 V1 W1 Δ L1 L2 L3
W2 U2 V2 U1 V1 W1 Y L1 L2 L3
Y-ONLY START / SOMENTE PARTIDA
6322-C3(60g) MOBIL POLYREX EM
6319-C3(45g) 4500 h

***Figure 2.1*** *- IEC motor nameplate*



MADE IN BRAZIL
W22 NEMA Premium®
*Inverter Duty Motor*
*Severe Duty*
MODEL:01018ET3E215T-W22
PH 3 HP(kW) 10(7.5) FRAME 213/5T RPM 1760
V 208-230/ 460 Hz 60 SF 1.25 NEMA NOM. EFF. 91.7 %
A 24.8/12.4 INS. CL. F Δt 80 K P.F. 0.83 DUTY CONT.
SFA 31/15.5 A ENCL. TEFC IP55 AMB. 40°C ALT. 1000 m.a.s.l.
50Hz 1 OHP 380V 15.0A 1445RPM SF1.0 CODE H DES B
RUN CONNECTION
208-230 V(60Hz) T4 T5 T6 T7 T8 T9 T1 T2 T3 ΔΔ L1 L2 L3
460 V(60Hz) 380 V(50Hz) T4 T5 T6 T7 T8 T9 T1 T2 T3 Δ L1 L2 L3
6308-ZZ
6207-ZZ
MOBIL POLYREX EM
MOD.TE1BF0X0N 182Lbs
USABLE AT 208V 27.4 A FOR USE ON VPWM VFD 1000:1VT, 20:1CT, 1.0SF,T3.
11437961
Class I, Div. 2, Gr. A, B, C & D - T3
Class I, Zone 2, IIC - T3
Class II, Div. 2, Gr. F and G - T4
CC029A
CSA E



W22 NEMA Premium® CC029A
Inverter Duty Motor
Severe Duty
FOR SAFE AREA
MOD.TE1BF0X0N
Class I, Div. 2, Gr. A, B, C & D – T3
Class I, Zone 2, IIC – T3
Class II, Div 2, Gr. F and G – T4
C US Energy Verified
CAUTION: USE SUPPLY WIRES SUITABLE FOR 110°C
MADE IN BRAZIL
11166657

PH 3 HP(kW) 75(55) FRAME 364/5T
V 208-230/460 Hz 60
A 186-168/84.1 SF 1.25
RPM 1775 SFA 210/105 A INS. CL. F △t 80 k
NEMA NOM. EFF. 95.4 % P.F. 0.86
CODE G DES B AMB. 40°C DUTY CONT.
ENCL. TEFC IP55 WEIGHT 923 Lbs
USABLE AT 208V 186 A 50Hz 75HP 380V 103A 1465 RPM SF1.0
ALT. 1000 m.a.s.l.
RUN CONNECTION
230 V(60Hz) ΔΔ
460 V(60Hz) 380 V(50Hz) Δ
6314-C3(27g) MOBIL POLYREX EM
6314-C3(27g) 12000 h
FOR USE ON VPWM VFD 1000:1VT, 20:1CT, 1.0SF,T3.

HGF
LR 110298
MADE IN BRAZIL
12774002

PH 3 HP 700 FRAME 6806/7/8T
V 480 Hz 60
A 755 SF 1.00
RPM 1192 SFA INS. CL. F
NEMA NOM. EFF. 96.5 % P.F. 0.85
CODE G DES AMB. 40°C DUTY CONT.
ENCL. TEFC TYPE ET WEIGHT 8339 Lbs
Alt. 1000 m.a.s.l.
480 V
Δ DELTA RUN
6324-C3(72g) MOBIL POLYREX EM
6319-C3(45g) 4500 h

***Figure 2.2*** *- NEMA motor nameplate*

ENGLISH

# 3. SAFETY INSTRUCTIONS

⚠ The motor must be disconnected from the power supply and be completely stopped before conducting any installation or maintenance procedures. Additional measures should be taken to avoid accidental motor starting.

⚠ Professionals working with electrical installations, either in the assembly, operation or maintenance, should use proper tools and be instructed on the application of standards and safety requirements, including the use of Personal Protective Equipment (PPE) that must be carefully observed in order to reduce risk of personal injury during these services.

⚠ Electric motors have energized circuits, exposed rotating parts and hot surfaces that may cause serious injury to people during normal operation. It is recommended that transportation, storage, installation, operation and maintenance services are always performed by qualified personnel.

Always follow the safety, installation, maintenance and inspection instructions in accordance with the applicable standards in each country.

# 4. HANDLING AND TRANSPORT

Individually packaged motors should never be lifted by the shaft or by the packaging. They must be lifted only by means of the eyebolts, when supplied. Use always suitable lifting devices to lift the motor. Eyebolts on the frame are designed for lifting the machine weight only as indicated on the motor nameplate. Motors supplied on pallets must be lifted by the pallet base with lifting devices fully supporting the motor weight.

The package should never be dropped. Handle it carefully to avoid bearing damage.

Eyebolts provided on the frame are designed for lifting the machine only. Do not use these eyebolts for lifting the motor with coupled equipment such as bases, pulleys, pumps, reducers, etc..

Never use damaged, bent or cracked eyebolts. Always check the eyebolt condition before lifting the motor.

Eyebolts mounted on components, such as on end shields, forced ventilation kits, etc. must be used for lifting these components only. Do not use them for lifting the complete machine set.

Handle the motor carefully without sudden impacts to avoid bearing damage and prevent excessive mechanical stresses on the eyebolts resulting in its rupture.

To move or transport motors with cylindrical roller bearings or angular contact ball bearings, use always the shaft locking device provided with the motor.
All HGF motors, regardless of bearing type, must be transported with shaft locking device fitted.

## 4.1. LIFTING

Before lifting the motor ensure that all eyebolts are tightened properly and the eyebolt shoulders are in contact with the base to be lifted, as shown in Figure 4.1. Figure 4.2 shows an incorrect tightening of the eyebolt.
Ensure that lifting machine has the required lifting capacity for the weight indicated on the motor nameplate.

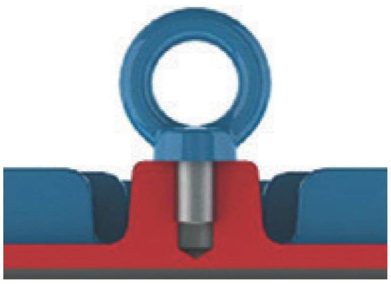


***Figure 4.1*** *- Correct tightening of the eyebolt*

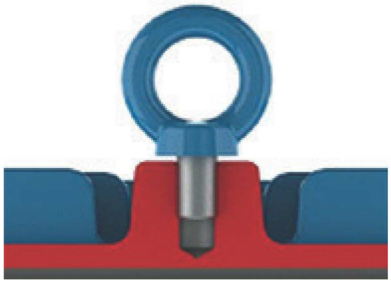


***Figure 4.2*** *- Incorrect tightening of the eyebolt*

The center-of-gravity may change depending on motor design and accessories. During the lifting procedures the maximum allowed angle of inclination should never be exceeded as specified below.

### 4.1.1. Horizontal motors with one eyebolt

For horizontal motors fitted with only one eyebolt, the maximum allowed angle-of-inclination during the lifting process should not exceed 30° in relation to the vertical axis, as shown in Figure 4.3.

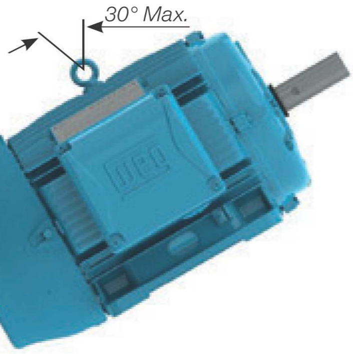


***Figure 4.3*** *- Maximum allowed angle-of-inclination for motor with one eyebolt*

### 4.1.2. Horizontal motor with two eyebolts

When motors are fitted with two or more eyebolts, all supplied eyebolts must be used simultaneously for the lifting procedure.

There are two possible eyebolt arrangements (vertical and inclined), as shown below:

- For motors with vertical lifting eyebolts, as shown in Figure 4.4, the maximum allowed lifting angle should not exceed 45° in relation to the vertical axis. We recommend to use a spreader bar for maintaining the lifting elements (chain or rope) in vertical position and thus preventing damage to the motor surface;

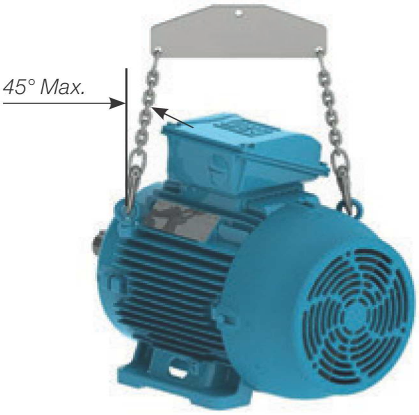


***Figure 4.4*** *- Maximum resulting angle for motors with two or more lifting eyebolts*

- For HGF, W40 and W50 motors, as shown in Figure 4.5, the maximum resulting angle should not exceed 30° in relation to the vertical axis;

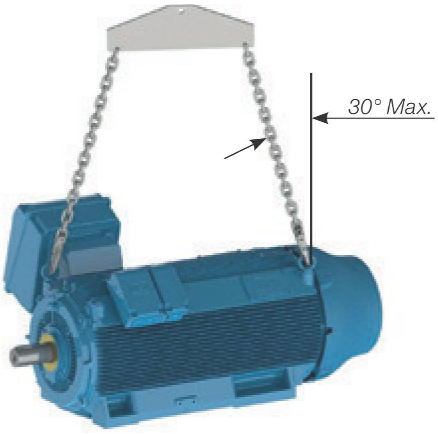


***Figure 4.5*** *- Maximum resulting angle for horizontal HGF, W40 and W50 motors*

- For motors fitted with inclined eyebolts, as shown in Figure 4.6, the use of a spreader bar is required for maintaining the lifting elements (chain or rope) in vertical position and thus preventing damage to the motor surface.

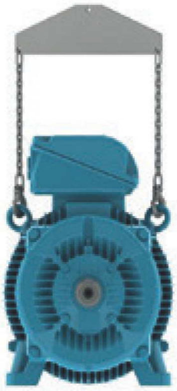


***Figure 4.6*** *- Use of a spreader bar for lifting*

### 4.1.3. Vertical motors

For vertical mounted motors, as shown in Figure 4.7, the use of a spreader bar is required for maintaining the lifting element (chain or rope) in vertical position and thus preventing damage to the motor surface.

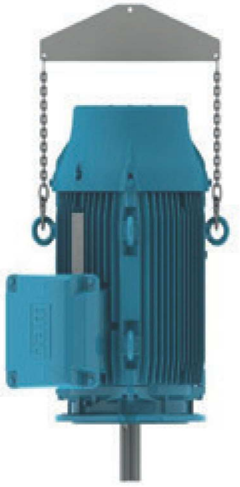


***Figure 4.7*** *- Lifting of vertical mounted motors*

Always use the eyebolts mounted on the top side of the motor, diametrically opposite, considering the mounting position. See Figure 4.8.

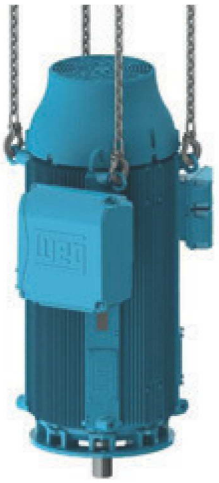


***Figure 4.8*** *- Lifting of HGF and W50 motors.*

#### 4.1.3.1. Procedures to place W22 motors in the vertical position

For safety reasons during the transport, vertical mounted Motors are usually packed and supplied in horizontal position.
To place W22 motors fitted with eyebolts (see Figure 4.6), to the vertical position, proceed as follows:

1. Ensure that the eyebolts are tightened properly, as shown in Figure 4.1;
2. Remove the motor from the packaging, using the top mounted eyebolts, as shown in Figure 4.9;

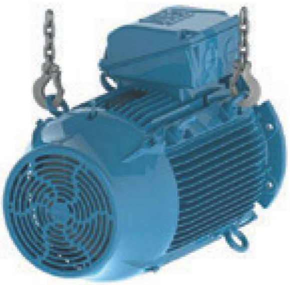


***Figure 4.9*** *- Removing the motor from the packaging*

3. Install a second pair of eyebolts, as shown in Figure 4.10;

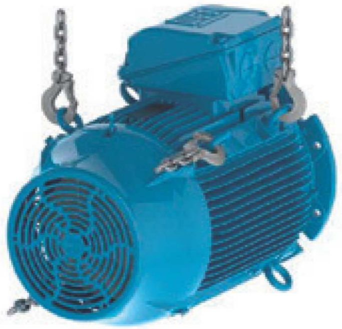


***Figure 4.10*** *- Installation of the second pair of eyebolts*

4. Reduce the load on the first pair of eyebolts to start the motor rotation, as shown in Figure 4.11. This procedure must be carried out slowly and carefully.

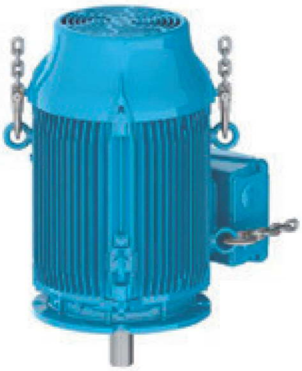


***Figure 4.11*** *- End result: motor placed in vertical position*

These procedures will help you to move motors designed for vertical mounting. These procedures are also used to place the motor from the horizontal position into the vertical position and vertical to horizontal.

#### 4.1.3.2. Procedures to place HGF and W50 motors in the vertical position

HGF motors are fitted with eight lifting points: four at drive end and four at non-drive end. W50 motors are fitted with nine lifting points: four at drive end, one in the central part and four at non-drive end. The motors are usually transported in horizontal position, however for the installation they must be placed in the vertical position.
To place an these motors in the vertical position, proceed as follows:

1. Lift the motor by using the four lateral eyebolts and two hoists, see Figure 4.12;

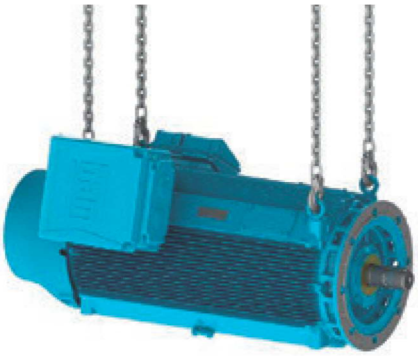


***Figure 4.12*** *- Lifting of HGF and W50 motors with two hoists*

2. Lower the hoist fixed to motor drive end while lifting the hoist fixed to motor non-drive end until the motor reaches its equilibrium, see Figure 4.13;

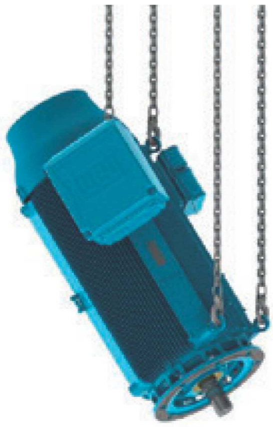


***Figure 4.13*** *- Placing HGF and W50 motors in vertical position*

3. Remove the hoist hooks from the drive end eyebolts and rotate the motor 180° to fix the removed hooks into the two eyebolts at the motor non-drive end, see Figure 4.14;

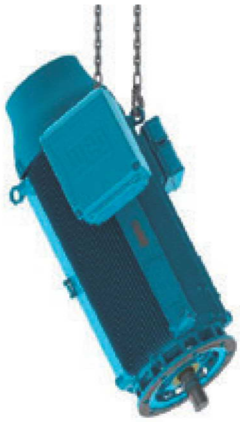


***Figure 4.14*** *- Lifting HGF and W50 motors by the eyebolts at the non-drive end*

4. Fix the removed hoist hooks in the other two eyebolts at the non-drive end and lift the motor until the vertical position is reached, see Figure 4.15.

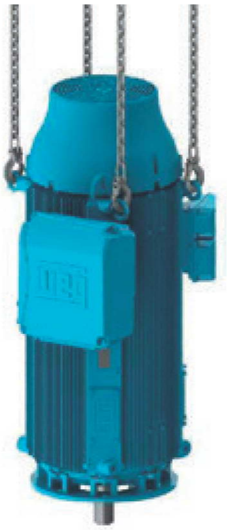


***Figure 4.15*** *- HGF and W50 motors in the vertical position*

These procedures will help you to move motors designed for vertical mounting. These procedures are also used to place the motor from the horizontal position into the vertical position and vertical to horizontal.

### 4.2 Procedures to place W22 vertical mount motors in horizontal position

To place W22 vertical mount motor in horizontal position, proceed as follows:

1. Ensure that all eyebolts are tightened properly, as shown in Figure 4.1;

2. Install the first pair of eyebolts and lift the motor as shown in Figure 4.16;

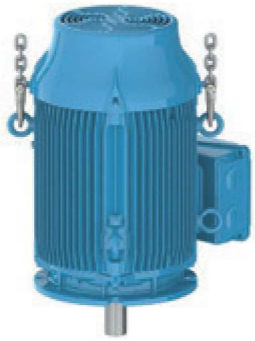


***Figure 4.16 -*** *Install the first pair of eyebolts*

3. Install the second pair of eyebolts, as shown in Figure 4.17;

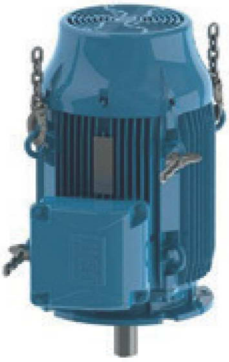


***Figure 4.17 -*** *Install the second pair of eyebolts*

4. Reduce the load on the first pair of eyebolts for rotating the motor, as shown in Figure 4.18. This procedure must be carried out slowly and carefully;

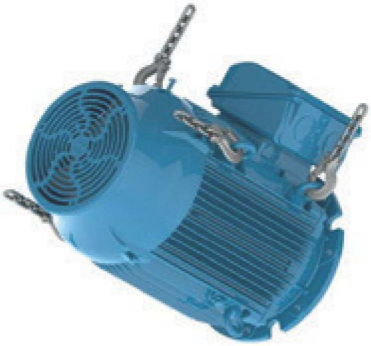


***Figure 4.18 -*** *Motor is being rotated to horizontal position*

5. Remove the first pair of eyebolts, as shown in Figure 4.19.

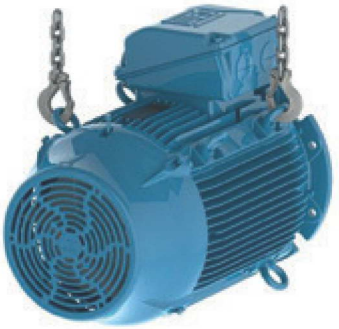


***Figure 4.19 -*** *Final result: motor placed in horizontal position*

# 5. STORAGE

If the motor is not installed immediately, it must be stored in a dry and clean environment, with relative humidity not exceeding 60%, with an ambient temperature between 5 ºC and 40 ºC, without sudden temperature changes, free of dust, vibrations, gases or corrosive agents. The motor must be stored in horizontal position, unless specifically designed for vertical operation, without placing objects on it. Do not remove the protection grease from shaft end to prevent rust.

If the motor are fitted with space heaters, they must always be turned on during the storage period or when the installed motor is out of operation. Space heaters will prevent water condensation inside the motor and keep the winding insulation resistance within acceptable levels. Store the motor in such position that the condensed water can be easily drained. If fitted, remove pulleys or couplings from the shaft end (more information are given on item 6).

The space heaters should never be energized when the motor is in operation.

## 5.1. EXPOSED MACHINED SURFACES

All exposed machined surfaces (like shaft end and flange) are factory-protected with temporary rust inhibitor. A protective film must be reapplied periodically (at least every six months), or when it has been removed and/or damaged.

## 5.2. STORAGE

The stacking height of the motor packaging during the storage period should not exceed 5 m, always considering the criteria indicated in Table 5.1:

***Table 5.1*** *- Max. recommended stacking height*

| Packaging type | Frame sizes | Maximum stacking quantity |
|---|---|---|
| **Cardboard box** | IEC 63 to 132<br>NEMA 143 to 215 | Indicated on the top side of the cardboard box |
| **Wood crate** | IEC 63 to 315<br>NEMA 48 to 504/5 | 06 |
| | IEC 355<br>NEMA 586/7 and 588/9 | 03 |
| | W40 / W50 / HGF IEC 315 to 630<br>W40 / W50 / HGF NEMA 5000 to 9600 | Indicated on the packaging |

***Notes****:*
*1) Never stack larger packaging onto smaller packaging;*
*2) Align the packaging correctly (see Figure 5.1 and Figure 5.2);*

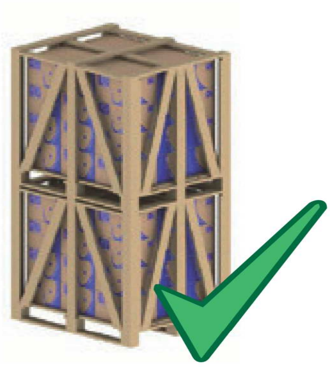


***Figure 5.1*** *- Correct stacking*

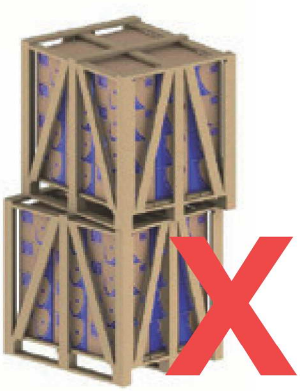


***Figure 5.2*** *- Incorrect stacking*

*3) The feet of the crates above should always be supported by suitable wood battens (Figure 5.3) and never stand on the steel tape or without support (Figure 5.4);*

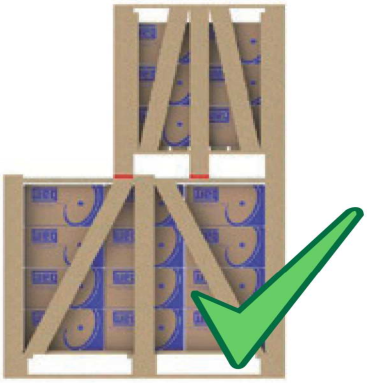


*Figure 5.3 - Correct stacking*

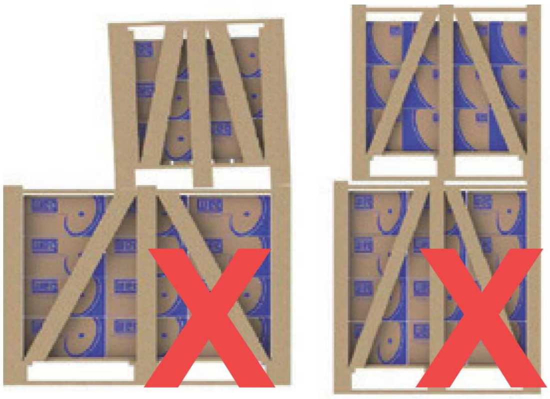


*Figure 5.4 - Incorrect stacking*

*4) When stacking smaller crates onto longer crates, always ensure that suitable wooden supports are provided to withstand the weight (see Figure 5.5). This condition usually occurs with motor packaging above IEC 225S/M (NEMA 364/5T) frame sizes.*

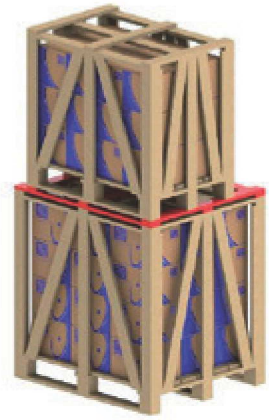


***Figure 5.5** - Use of additional battens for stacking*

## 5.3 BEARINGS

### 5.3.1 Grease lubricated bearings

We recommend rotating the motor shaft at least once a month (by hand, at least five revolutions, stopping the shaft at a different position from the original one). If the motor is fitted with shaft locking device, remove it before rotating the shaft and install it again before performing any handling procedure. Vertical motors may be stored in the vertical or in horizontal position. If motors with open bearings are stored longer than six months, the bearings must be relubricated according to item 8.2 before commissioning of the motor.
If the motor is stored for longer than 2 years, the bearings must be replaced or removed, washed, inspected and relubricated according to item 8.2.

### 5.3.2 Oil lubricated bearings

The motor must be stored in its original operating position and with oil in the bearings. Correct oil level must be ensured. It should be in the center of the sight glass.
During the storage period, remove the shaft locking device and rotate the shaft by hand every month, at least five revolutions, thus achieving an even oil distribution inside the bearing and maintaining the bearing in good operating conditions. Reinstall the shaft locking device every time the motor has to be moved.
If the motor is stored for a period equal or longer than the oil change interval, the oil must be replaced according to Item 8.2, before starting the operation. If the motor is stored for a period of over two years, the bearings must be replaced or removed, washed according to manufacturer instructions, checked and relubricated according to Item 8.2. The oil of vertical mounted motors is removed to prevent oils leaks during the transport. After receiving the motor the bearings must be lubricated.

### 5.3.3 Oil Mist lubricated bearings

The motor must be stored in horizontal position. Lubricate the bearings with ISO VG 68 mineral oil in the amount indicated in the Table 5.2 (this is also valid for bearings with equivalent dimensions). After filling with oil, rotate the shaft by hand, at least five revolutions)
During the storage period, remove the shaft locking device (if any) and rotate the shaft by hand every week, at least five revolutions, stopping it at a different position from the original one. Reinstall the shaft locking device every time the motor has to be moved. If the motor is stored for a period of over two years, the bearings must be replaced or removed, washed according to manufacturer instructions, checked and relubricated according to item 8.2.

***Table 5.2 -*** *Amount of oil per bearing*

| Bearing size | Amount of oil (ml) | Bearing size | Amount of oil (ml) |
|---|---|---|---|
| 6201 | 15 | 6309 | 65 |
| 6202 | 15 | 6311 | 90 |
| 6203 | 15 | 6312 | 105 |
| 6204 | 25 | 6314 | 150 |
| 6205 | 25 | 6315 | 200 |
| 6206 | 35 | 6316 | 250 |
| 6207 | 35 | 6317 | 300 |
| 6208 | 40 | 6319 | 350 |
| 6209 | 40 | 6320 | 400 |
| 6211 | 45 | 6322 | 550 |
| 6212 | 50 | 6324 | 600 |
| 6307 | 45 | 6326 | 650 |
| 6308 | 55 | 6328 | 700 |

The oil must always be removed when the motor has to be handled. If the oil mist system is not operating after installation, fill the bearings with oil to prevent bearing rusting. During the storage period, rotate the shaft by hand, at least five revolutions, stopping it at a different position from the original one. Before starting the motor, all bearing protection oil must be drained from the bearing and the oil mist system must be switched ON.

### 5.3.4 Sleeve bearing

The motor must be stored in its original operating position and with oil in the bearings. Correct oil level must be ensured. It should be in the middle of the sight glass. During the storage period, remove the shaft locking device and rotate the shaft by hand every month, at least five revolutions, and at 30 rpm, thus achieving an even oil distribution inside the bearing and maintaining the bearing in good operating conditions. Reinstall the shaft locking device every time the motor has to be moved.
If the motor is stored for a period equal or longer than the oil change interval, the oil must be replaced, according to Item 8.2, before starting the operation.

If the motor is stored for a period longer than the oil change interval, or if it is not possible to rotate the motor shaft by hand, the oil must be drained and a corrosion protection and dehumidifiers must be applied.

## 5.4. INSULATION RESISTANCE

We recommend measuring the winding insulation resistance at regular intervals to follow-up and evaluate its electrical operating conditions. If any reduction in the insulation resistance values are recorded, the storage conditions should be evaluated and corrected, where necessary.

### 5.4.1. Insulation resistance measurement

We recommend measuring the winding insulation resistance at regular intervals to follow-up and evaluate its electrical operating conditions. If any reduction in the insulation resistance values are recorded, the storage conditions should be evaluated and corrected, where necessary.

⚠ The insulation resistance must be measured in a safe environment.

The insulation resistance must be measured with a megohmmeter. The machine must be in cold state and disconnected from the power supply.

To prevent the risk of an electrical shock, ground the terminals before and after each measurement. Ground the capacitor (if any) to ensure that it is fully discharged before the measurement is taken.

It is recommended to insulate and test each phase separately. This procedure allows the comparison of the insulation resistance between each phase. During the test of one phase, the other phases must be grounded. The test of all phases simultaneously evaluates the insulation resistance to ground only but does not evaluate the insulation resistance between the phases.
The power supply cables, switches, capacitors and other external devices connected to the motor may considerably influence the insulation resistance measurement. Thus all external devices must be disconnected and grounded during the insulation resistance measurement.
Measure the insulation resistance one minute after the voltage has been applied to the winding. The applied voltage should be as shown in Table 5.3.

***Table 5.3*** *- Voltage for the insulation resistance*

| Winding rated voltage (V) | Testing voltage for measuring the insulation resistance (V) |
|---|---|
| < 1000 | 500 |
| 1000 - 2500 | 500 - 1000 |
| 2501 - 5000 | 1000 - 2500 |
| 5001 - 12000 | 2500 - 5000 |
| > 12000 | 5000 - 10000 |

The reading of the insulation resistance must be corrected to 40 °C as shown in the Table 5.4.

***Table 5.4*** *- Correction factor for the insulation resistance corrected to 40 °C*

| Measuring temperature of the insulation resistance (°C) | Correction factor of the insulation resistance corrected to 40 °C | Measuring temperature of the insulation resistance (°C) | Correction factor of the insulation resistance corrected to 40 °C |
|---|---|---|---|
| 10 | 0.125 | 30 | 0.500 |
| 11 | 0.134 | 31 | 0.536 |
| 12 | 0.144 | 32 | 0.574 |
| 13 | 0.154 | 33 | 0.616 |
| 14 | 0.165 | 34 | 0.660 |
| 15 | 0.177 | 35 | 0.707 |
| 16 | 0.189 | 36 | 0.758 |
| 17 | 0.203 | 37 | 0.812 |
| 18 | 0.218 | 38 | 0.871 |
| 19 | 0.233 | 39 | 0.933 |
| 20 | 0.250 | 40 | 1.000 |
| 21 | 0.268 | 41 | 1.072 |
| 22 | 0.287 | 42 | 1.149 |
| 23 | 0.308 | 43 | 1.231 |
| 24 | 0.330 | 44 | 1.320 |
| 25 | 0.354 | 45 | 1.414 |
| 26 | 0.379 | 46 | 1.516 |
| 27 | 0.406 | 47 | 1.625 |
| 28 | 0.435 | 48 | 1.741 |
| 29 | 0.467 | 49 | 1.866 |
| 30 | 0.500 | 50 | 2.000 |

The motor insulation condition must be evaluated by comparing the measured value with the values indicated in Table 5.5 (corrected to 40 °C):

***Table 5.5*** *- Evaluation of the insulation system*

| **Limit value for rated voltage up to 1.1 kV (MΩ)** | **Limit value for rated voltage above 1.1 kV (MΩ)** | **Situation** |
|---|---|---|
| Up to 5 | Up to 100 | Dangerous. The motor can not be operated in this condition |
| 5 to 100 | 100 to 500 | Regular |
| 100 to 500 | Higher than 500 | Good |
| Higher than 500 | Higher than 1000 | Excellent |

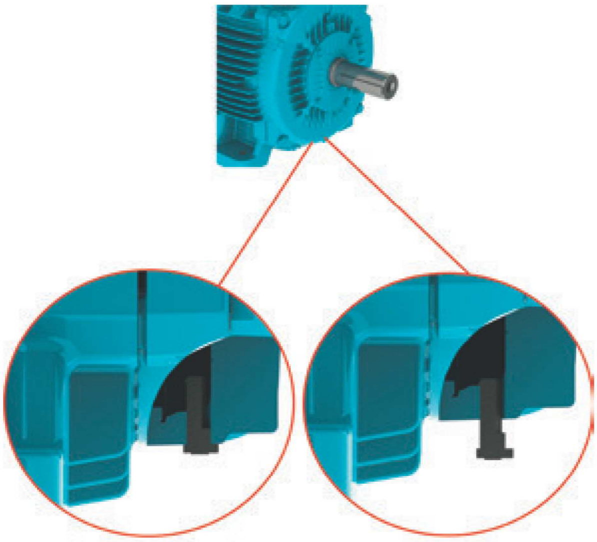
The values indicated in the table should be considered only as reference values. It is advisable to log all measured values to provide a quick and easy overview on the machine insulation resistance.
If the insulation resistance is low, moisture may be present in the stator windings. In this case the motor should be removed and transported to a WEG authorized Service Center for proper evaluation and repair (This service is not covered by the warranty). To improve the insulation resistance through the drying process, see section 8.4.

# 6. INSTALLATION

The insulation resistance must be measured in a safe environment.

Check some aspects before proceeding with the installation:

1. Insulation resistance: must be within the acceptable limits. See item 5.4.
2. Bearings:
   a. Rolling bearings: oxidized bearings must be replaced. If no oxidation is detected, lubricate the bearings as described in Item 8.2. If the motor is stored for a period of over two years, the bearings must be replaced before starting the motor;
   b. Sleeve bearing: if sleeve bearing motors are stored longer than the recommended oil change interval, the oil must be changed before machine starting. Don't forget to remove the dehumidifiers when you drain the oil from the motor and to fill it again with new oil before starting the machine. For more details, see item 8.2.
3. Operating conditions of the start capacitors: If single-phase motors are stored for a period of over two years, it is recommended to change the start capacitors before motor starting since they lose their operating characteristics.
4. Terminal box:
   a. the inside of the terminal box must be clean and dry;
   b. the contacts must be correctly connected and corrosion free. See 6.9 and 6.10;
   c. the cable entries must be correctly sealed and the terminal box cover properly mounted in order to ensure the degree of protection indicated on the motor nameplate.
5. Cooling: the cooling fins, air inlet and outlet openings must be clean and unobstructed. The distance between the air inlet openings and the wall should not be shorter than ¼ (one quarter) of the diameter of the air inlet. Ensure sufficient space to perform the cleaning services. See item 7.
6. Coupling: remove the shaft locking device (where fitted) and the corrosion protection grease from the shaft end and flange just before installing the motor. See item 6.4.
7. Drain hole: the motor must always be positioned so the drain hole is at the lowest position (If there is any indication arrow on the drain, the drain must be so installed that the arrow points downwards).
   Motors supplied with rubber drain plugs leave the factory in the closed position and must be opened periodically to allow the exit of condensed water. For environments with high water condensation levels and motor with degree of protection IP55, the drain plugs can be mounted in open position (see Figure 6.1).
   For motors with degree of protection IP56, IP65 or IP66, the drain plugs must remain at closed position (see Figure 6.1), being opened only during the motor maintenance procedures.
   The drain system of motors with Oil Mist lubrication system must be connected to a specific collection system (see Figure 6.12).



Closed position

Open position

***Figure 6.1*** *- Detail of the rubber drain plug mounted in closed and open position*

8. Additional recommendations:
  a. Check the direction of motor rotation, starting the motor at no-load before coupling it to the load;
  b. Vertical mounted motors with shaft end down must be fitted with drip cover to protect them from liquids or solids that may drop onto the motors;
  c. Vertical mounted motors with shaft end up must be fitted with water slinger ring to prevent water penetration inside the motor.

Remove or fix the shaft key before starting the motor.

Changes on the motor construction (features), such as installation of extended grease fittings or modification of the lubrication system, installation of accessories at alternative locations, etc., can be carried out only after prior written consent from WEG.

## 6.1. FOUNDATIONS

The foundation is the structure, structural element, natural or prepared base, designed to withstand the stresses produced by the installed equipment, ensuring safe and stable performance during operation. The foundation design should consider the adjacent structures to avoid the influences of other installed equipment and no vibration is transferred through the structure

The foundation must be flat and its selection and design must consider the following characteristics:

a) The features of the machine to be installed on the foundation, the driven loads, application, maximum allowed deformations and vibration levels (for instance, motors with reduced vibration levels, foot flatness, flange concentricity, axial and radial loads, etc. lower than the values specified for standard motors).

b) Adjacent buildings, conservation status, maximum applied load estimation, type of foundation and fixation and vibrations transmitted by theses constructions.

If the motor is supplied with leveling/alignment bolts, this must be considered in the base design.

Please consider for the foundation dimensioning all stresses that are generated during the operation of the driven load.
The user is responsible for the foundation designing and construction.

The foundation stresses can be calculated by using the following equations (see Figure 6.2):

$$F_1 = 0{,}5 * g * m - (4 * T_b / A)$$
$$F_2 = 0{,}5 * g * m + (4 * T_b / A)$$

Where:

$F_1$ and $F_2$ = lateral stresses (N);
$g$ = gravitational acceleration (9,8 m/s$^2$);
$m$ = motor weight (kg);
$T_b$ = breakdown torque (Nm);
$A$ = distance between centerlines of mounting holes in feet or base of the machine (end view) (m).

The motors may be mounted on:

- Concrete bases: are most used for large-size motors (see Figure 6.2);
- Metallic bases: are generally used for small-size motors (see Figure 6.3).

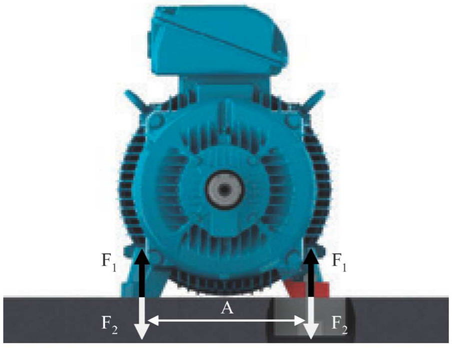


***Figure 6.2*** *- Motor installed on concrete base*

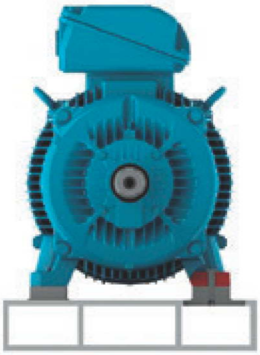


***Figure 6.3*** *- Motor installed on metallic base*

The metallic and concrete bases may be fitted with sliding system. These types of foundations are generally used where the power transmission is achieved by belts and pulleys. This power transmission system is easier to assemble/disassemble and allows the belt tension adjustment. Other important aspect of this foundation type is the location of the base locking screws that must be diagonally opposite. The rail nearest the drive pulley is placed in such a way that the positioning bolt is between the motor and the driven machine. The other rail must be placed with the bolt on the opposite side (diagonally opposite), as shown in Figure 6.4 .

To facilitate assembly, the bases may have the following features:

- Shoulders and/or recesses;
- Anchor bolts with loose plates;
- Bolts cast in the concrete;
- Leveling screws;
- Positioning screws;
- Steel & cast iron blocks, plates with flat surfaces.

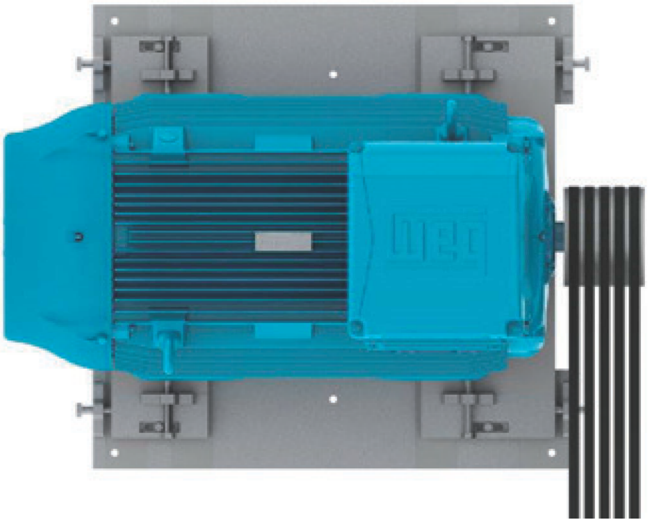


***Figure 6.4*** *- Motor installed on sliding base*

After completing the installation, it is recommended that all exposed machined surfaces are coated with suitable rust inhibitor.

## 6.2. MOTOR MOUNTING

Footless motors supplied with transportation devices, according to Figure 6.5, must have their devices removed before starting the motor installation.

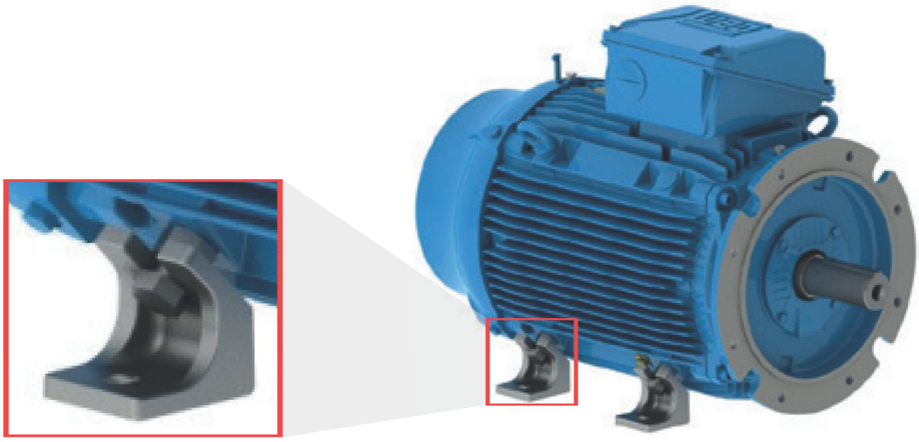


***Figure 6.5*** *- Detail of the transportation devices for footless motors*

### 6.2.1. Foot mounted motors

The drawings of the mounting hole dimensions for NEMA or IEC motors can be checked in the respective technical catalogue.
The motor must be correctly aligned and leveled with the driven machine. Incorrect alignment and leveling may result in bearing damage, generate excessive vibration and even shaft distortion/breakage.
For more details, see section 6.3 and 6.6. The thread engagement length of the mounting bolt should be at least 1.5 times the bolt diameter. This thread engagement length should be evaluated in more severe applications and increased accordingly.
Figure 6.6 shows the mounting system of a foot mounted motor indicating the minimum required thread engagement length.

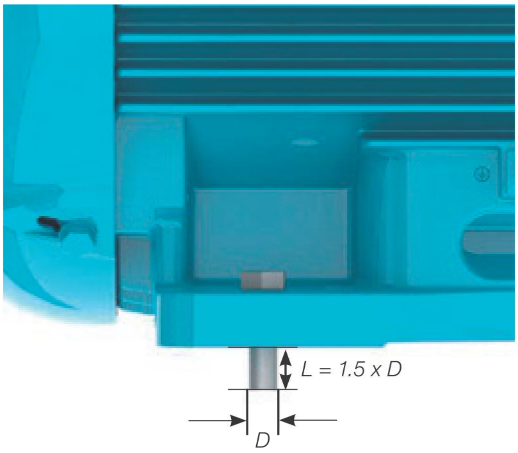


***Figure 6.6*** *- Mounting system of a foot mounted motor*

### 6.2.2. Flange mounted motors

The drawings of the flange mounting dimensions, IEC and NEMA flanges, can be checked in the technical catalogue.
The coupling of the driven equipment to the motor flange must be properly dimensioned to ensure the required concentricity of the assembly.
Depending on the flange type, the mounting can be performed from the motor to the driven equipment flange (flange FF (IEC) or D (NEMA)) or from the driven equipment flange to the motor (flange C (DIN or NEMA)).
For the mounting process from the driven equipment flange to the motor, you must consider the bolt length, flange thickness and the thread depth of the motor flange.

If the motor flange has tapped through-holes, the length of the mounting bolts must not exceed the tapped through-hole length of the motor flange, thus preventing damage to the winding head.

For flange mounting the thread engagement length of the mounting bolt should be at least 1.5 times the bolt diameter. In severe applications, longer thread engagement length may be required.
In severe applications or if large motors are flange mounted, a foot or pad mounting may be required in addition to the flange mounting (Figure 6.7). The motor must never be supported on its cooling fins.

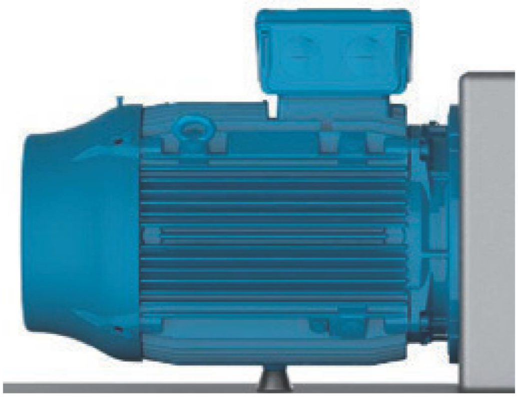


***Figure 6.7*** *- Mounting method of flange mounted motors with frame base support*

***Note**:*
*When liquid (for example oil) is likely to come into contact with the shaft seal, please contact your local WEG representative.*

### 6.2.3. Pad mounted motors

Typically, this method of mounting is used in axial fans. The motor is fixed by tapped holes in the frame. The dimensions of these tapped holes can be checked in the respective product catalogue. The selection of the motor mounting rods/bolts must consider the dimensions of the fan case, the installation base and the thread depth in the motor frame.
The mounting rods and the fan case wall must be sufficiently stiff to prevent the transmission of excessive vibration to the machine set (motor & fan). Figure 6.8 shows the pad mounting system.

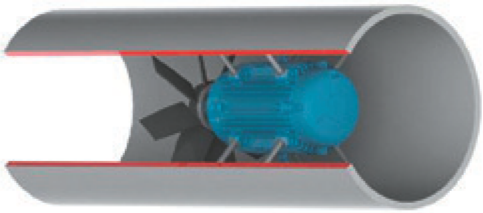


***Figure 6.8*** *- Mounting of the motor inside the cooling duct*

## 6.3. BALANCING

Unbalanced machines generate vibration which can result in damage to the motor. WEG motors are dynamically balanced with “half key” and without load (uncoupled). Special balancing quality level must be stated in the Purchase Order.

⚠ The transmission elements, such as pulleys, couplings, etc., must balanced with “half key” before they are mounted on the motor shaft.

The balance quality grade meets the applicable standards for each product line.

The maximum balancing deviation must be recorded in the installation report.

## 6.4. COUPLINGS

Couplings are used to transmit the torque from the motor shaft to the shaft of the driven machine. The following aspects must be considered when couplings are installed:

- Use proper tools for coupling assembly & disassembly to avoid damages to the motor and bearings;
- Whenever possible, use flexible couplings, since they can absorb eventual residual misalignments during the machine operation;
- The maximum loads and speed limits informed in the coupling and motor manufacturer catalogues cannot be exceeded;
- Level and align the motor as specified in sections 6.5 and 6.6, respectively.

Remove or fix the shaft key firmly when the motor is operated without coupling in order to prevent accidents.

### 6.4.1. Direct coupling

Direct coupling is characterized when the Motor shaft is directly coupled to the shaft of the driven machine without transmission elements. Whenever possible, use direct coupling due to lower cost, less space required for installation and more safety against accidents.

Do not use roller bearings for direct coupling, unless sufficient radial load is expected.

### 6.4.2. Gearbox coupling

Gearbox coupling is typically used where speed reduction is required.
Make sure that shafts are perfectly aligned and strictly parallel (in case of straight spur gears) and in the right meshing angle (in case of bevel and helical gears).

### 6.4.3. Pulley and belt coupling

Pulleys and belts are used when speed increase or reduction between motor shaft and driven load is required.

Excessive belt tension will damage the bearings and cause unexpected accidents such as breakage of the motor shaft.

### 6.4.4. Coupling of sleeve bearing motors

Motors designed with sleeve bearings must be operated with direct coupling to the driven machine or a gearbox. Pulley and belts can not be applied for sleeve bearing motors.

Motors designed with sleeve bearings have 3 (three) marks on the shaft end. The center mark is the indication of the magnetic center and the 2 (two) outside marks indicate the allowed limits of the rotor axial movement, as shown in Figure 6.9.
The motor must be so coupled that during operation the arrow on the frame is placed over the central mark indicating the rotor magnetic center. During start-up, or even during operation, the rotor may freely move between the two outside marks when the driven machine exerts an axial load on the motor shaft. However, under no circumstance, the motor can operate continuously with axial forces on the bearing.

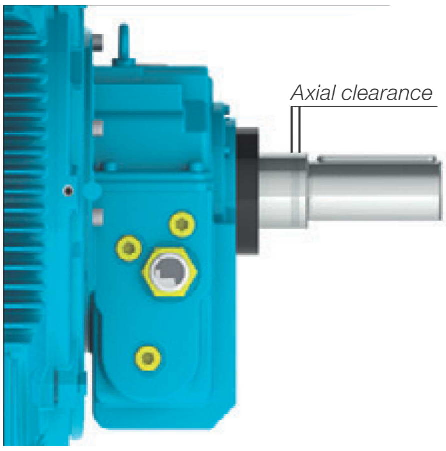


***Figure 6.9*** *- Axial clearance of motor designed with sleeve bearing*

For coupling evaluation consider the maximum axial bearing clearance as shown in Table 6.1.
The axial clearance of the driven machine and coupling influence the maximum bearing clearance.

***Table 6.1** - Clearance used for sleeve bearings*

| Bearing size | Total axial clearance (mm) |
|---|---|
| 9* | 3 + 3 = 6 |
| 11* | 4 + 4 = 8 |
| 14* | 5 + 5 =10 |
| 18 | 7,5 + 7,5 = 15 |

** For Motors in accordance with API 541, the total axial clearance is 12.7 mm*

The sleeve bearings used by WEG were not designed to support axial load continuously.
Under no circumstance must the motor be operated continuously at its axial clearance limits.

## 6.5. LEVELING

The motor must be leveled to correct any deviations in flatness arising from the manufacturing process and the material structure rearrangement. The leveling can be carried out by a leveling screw fixed on the motor foot or on the flange or by means of thin compensation shims. After the leveling process, the leveling height between the motor mounting base and the motor cannot exceed 0.1 mm.
If a metallic base is used to level the height of the motor shaft end and the shaft end of the driven machine, level only the metallic base relating to the concrete base.

Record the maximum leveling deviations in the installation report.

## 6.6. ALIGNMENT

The correct alignment between the motor and the driven machine is one of the most important variables that extends the useful service life of the motor. Incorrect coupling alignment generates high loads and vibrations reducing the useful life of the bearings and even resulting in shaft breakages. Figure 6.10 illustrates the misalignment between the motor and the driven machine.

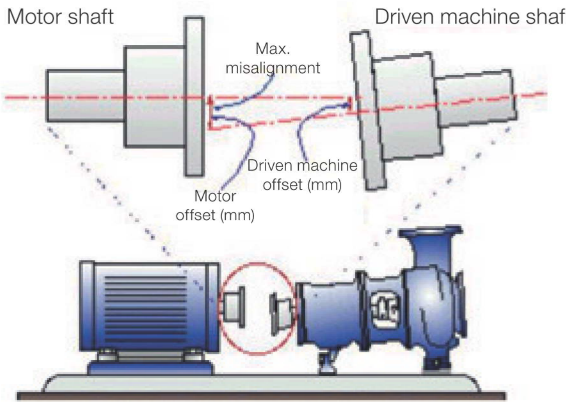
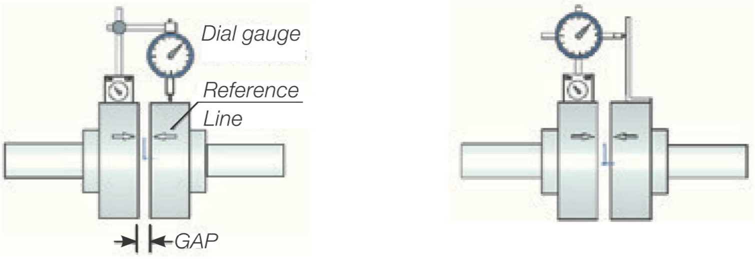


***Figure 6.10** - Typical misalignment condition*

Alignment procedures must be carried out using suitable tools and devices, such as dial gauge, laser alignment instruments, etc.. The motor shaft must be aligned axially and radially with the driven machine shaft.

The maximum allowed eccentricity for a complete shaft turn should not exceed 0.03 mm, when alignment is made with dial gauges, as shown in Figure 6.11. Ensure a gap between couplings to compensate the thermal expansion between the shafts as specified by the coupling manufacturer.



*Parallel alignment*

*Angular alignment*

***Figure 6.11** - Alignment with dial gauge*

ENGLISH

If alignment is made by a laser instrument, please consider the instructions and recommendations provided by the laser instrument manufacturer.
The alignment should be checked at ambient temperature with machine at operating temperature.

The coupling alignment must be checked periodically.

Pulley and belt couplings must be so aligned that the driver pulley center lies in the same plane of the driven pulley center and the motor shaft and the shaft of the driven machine are perfectly parallel.
After completing the alignment procedures, ensure that mounting devices do not change the motor and machine alignment and leveling resulting into machine damage during operation.

It is recommended to record the maximum alignment deviation in the Installation Report.

## 6.7. CONNECTION OF OIL LUBRICATED OR OIL MIST LUBRICATED MOTORS

When oil lubricated or oil mist lubricated motors are installed, connect the existing lubricant tubes (oil inlet and oil outlet tubes and motor drain tube), as shown in Figure 6.12. The lubrication system must ensure continuous oil flow through the bearings as specified by the manufacturer of the installed lubrication system.

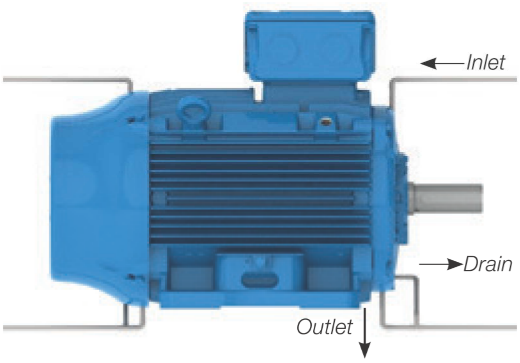


***Figure 6.12*** *- Oil supply and drain system of oil lubricated or oil mist lubricated motors*

## 6.8. CONNECTION OF THE COOLING WATER SYSTEM

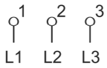
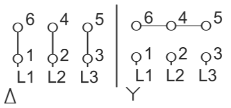
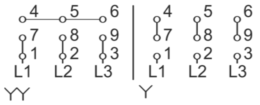
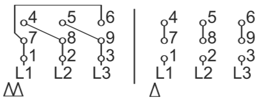
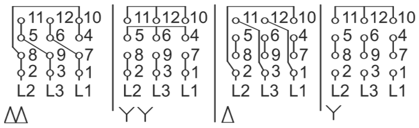
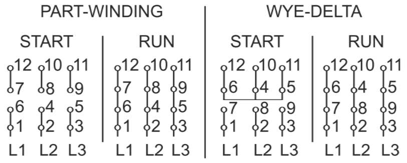
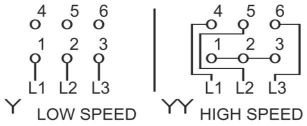
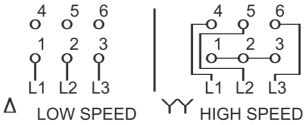
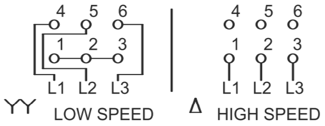
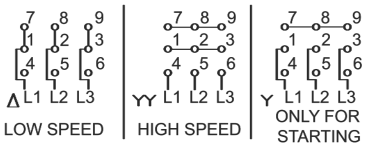
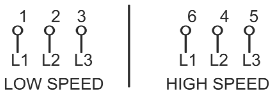
When water cooled motors are installed, connect the water inlet and outlet tubes to ensure proper motor cooling. According to item 7.2, ensure correct cooling water flow rate and water temperature in the motor cooling system.

## 6.9. ELECTRICAL CONNECTION

Consider the rated motor current, service factor, starting current, environmental and installation conditions, maximum voltage drop, etc. to select appropriate power supply cables and switching and protection devices. All motors must be installed with overload protection systems. Three-phase motors should be fitted with phase fault protection systems.

Before connecting the motor, check if the power supply voltage and the frequency comply with the motor nameplate data. All wiring must be made according to the connection diagram on the motor nameplate. Please consider the connection diagrams in the Table 6.2 as reference value.
To prevent accidents, check if motor has been solidly grounded in accordance with the applicable standards.

*Table 6.2* - *Typical connection diagram for three-phase motors.*

| Configuration | Quantity of leads | Type of connection | Connection diagram |
|---|---|---|---|
| Single speed | 3 | - |  |
|  | 6 | Δ - Y |  |
|  | 9 | YY - Y |  |
|  |  | ΔΔ - Δ |  |
|  | 12 | ΔΔ - YY - Δ - Y |  |
|  |  | Δ - PWS<br>Part-winding start |  |
| Double speed<br>Dahlander | 6 | YY - Y<br>Variable Torque |  |
|  |  | Δ - YY<br>Constant Torque |  |
|  |  | YY - Δ<br>Constant Output |  |
|  | 9 | Δ - Y - YY |  |
| Double speed<br>Double winding | 6 | - |  |

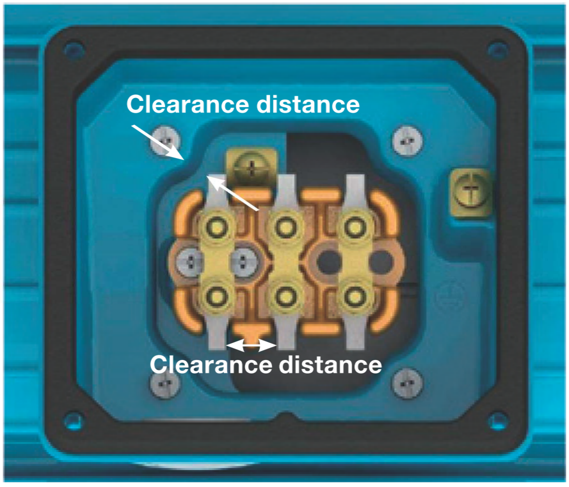
| Equivalent table for lead identification | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lead identification on the wiring diagram | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Single speed | NEMA MG 1 Part 2 | T1 | T2 | T3 | T4 | T5 | T6 | T7 | T8 | T9 | T10 | T11 | T12 |
|  | IEC 60034-8 | U1 | V1 | W1 | U2 | V2 | W2 | U3 | V3 | W3 | U4 | V4 | W4 |
|  | JIS (JEC 2137) - up to 6 terminals | U | V | W | X | Y | Z |  |  |  |  |  |  |
|  | JIS (JEC 2137) - above 6 terminals | U1 | V1 | W1 | U2 | V2 | W2 | U5 | V5 | W5 | U6 | V6 | W6 |
| Double speed (Dahlander / Double winding) | NEMA MG 1 Part 2[1)] | 1U | 1V | 1W | 2U | 2V | 2W | 3U | 3V | 3W | 4U | 4V | 4W |
|  | IEC 60034-8 | 1U | 1V | 1W | 2U | 2V | 2W | 3U | 3V | 3W | 4U | 4V | 4W |
|  | JIS (JEC 2137) | 1U | 1V | 1W | 2U | 2V | 2W | 3U | 3V | 3W | 4U | 4V | 4W |

*1) NEMA MG 1 Part 2  defines T1 to T12 for two or more winding, however WEG adopts 1U to 4W.*

If motors are supplied without terminal blocks, insulate the cable terminals with suitable insulation material that meets the power supply voltage and the insulation class indicated on the motor nameplate.

Ensure correct tightening torque for the power cable and grounding connections as specified in Table 8.7

The clearance distance (see Figure 6.13) between non-insulated live parts with each other and between grounded parts must be as indicated in Table 6.3.



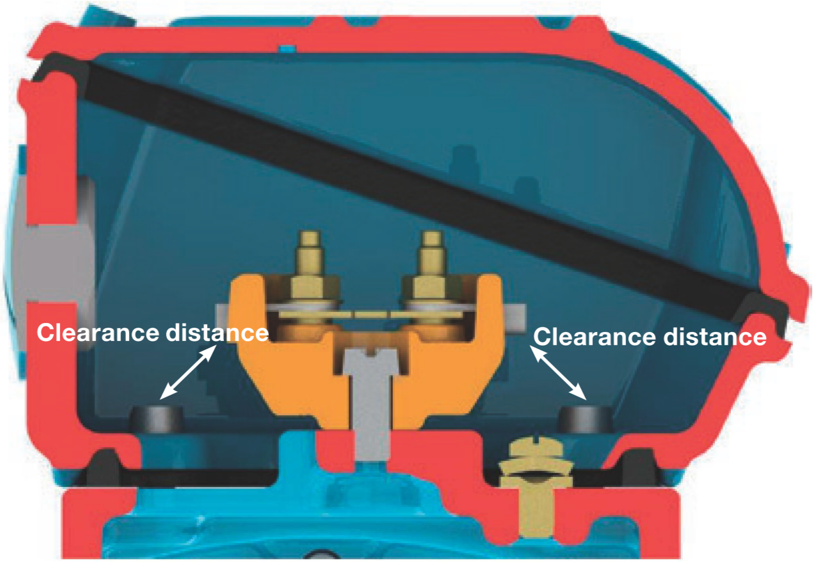


***Figure 6.13*** *- Clearance distance representation*

***Table 6.3*** *- Minimum clearance distance (mm) x supply voltage*

| Voltage | Minimum clearance distance (mm) |
|---|---|
| U ≤ 440 V | 4 |
| 440 < U ≤ 690 V | 5.5 |
| 690 < U ≤ 1000 V | 8 |
| 1000 < U ≤ 6900 V | 45 |
| 6900 < U ≤ 11000 V | 70 |
| 11000 < U ≤ 16500 V | 105 |

Even when the motor is off, dangerous voltages may be present inside the terminal box used for the space heater supply or winding energization when the winding is used as heating element.
Motor capacitors will hold a charge even after the power has been cut off. Do not touch the capacitors and/or motor terminals, before discharging the capacitors completely.

After the motor connection has been completed, ensure that no tool or foreign body has been left inside the terminal box.

Unused cable inlet holes in the terminal box must be properly closed to ensure the degree of protection indicated on the motor nameplate.
The cable inlets used for power supply and control must be fitted with components (for example, cable-glands and conduits) that meet the applicable standards and regulations in each country.

If the motor is fitted with accessories, such as brakes and forced cooling systems, these devices must be connected to the power supply according to the information provided on their nameplates and with special care as indicated above.

All protection devices, including overcurrent protection, must be set according to the rated machine conditions. These protection devices must protect the machine against short circuit, phase fault or locked rotor condition. The motor protection devices must be set according to the applicable standards.

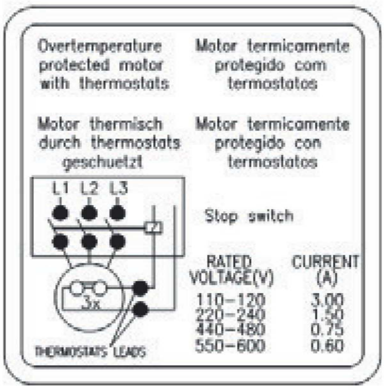
Check the direction of rotation of the motor shaft. If there is no limitation for the use of unidirectional fans, the shaft rotation direction can be changed by reversing any two of the phase connections. For single-phase motor, check the connection diagram indicated on the motor nameplate.

## 6.10. CONNECTION OF THE THERMAL PROTECTION DEVICES

If the motor is supplied with temperature monitoring devices, such as, thermostat, thermistors, automatic thermal protectors, Pt-100 (RTD), etc., they must be connected to the corresponding control devices as specified on the accessory nameplates. The non-compliance with this procedure may void the product warranty and cause serious material damages.

Do not apply test voltage above 2.5 V on thermistors and current above 1 mA on RTDs (Pt-100) according to IEC 60751 standard.

Figure 6.14 and Figure 6.15 show the connection diagram of the bimetal thermal protector (thermostats) and thermistors, respectively.


Overtemperature protected motor with thermostats
Motor termicamente protegido com termostatos
Motor thermisch durch thermostats geschuetzt
Motor termicamente protegido con termostatos
L1 L2 L3
Stop switch
3~
THERMOSTATS LEADS

| RATED VOLTAGE(V) | CURRENT (A) |
|---|---|
| 110-120 | 3.00 |
| 220-240 | 1.50 |
| 440-480 | 0.75 |
| 550-600 | 0.60 |

*Figure 6.14* - *Connection of the bimetal thermal protectors (thermostats)*

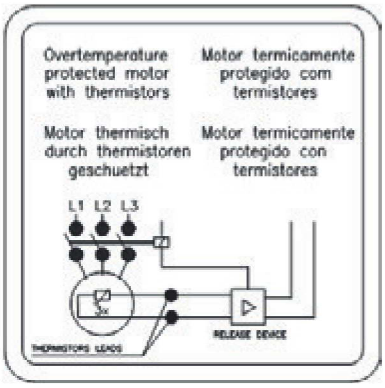

Overtemperature protected motor with thermistors
Motor termicamente protegido com termistores
Motor thermisch durch thermistoren geschuetzt
Motor termicamente protegido con termistores
L1 L2 L3
3~
THERMISTORS LEADS
RELEASE DEVICE

*Figure 6.15* - *Thermistor connection*

The alarm temperature limits and thermal protection shutdowns can be defined according to the application; however these temperature limits can not exceed the values in Table 6.4.

***Table 6.4*** *- Maximum activation temperature of the thermal protections*

| **Component** | **Insulation class** | **Maximum temperature of the protection setting (°C)** | |
|---|---|---|---|
| | | **Alarm** | **Tripping** |
| **Winding** | B | - | 130 |
| | F | 130 | 155 |
| | H | 155 | 180 |
| **Bearing** | All | 110 | 120 |

***Notes****:*

*1) The number and type of the installed protection devices are stated on the accessory nameplate of the motor.*

*2) If the motor is supplied with calibrated resistance, (for example, Pt-100), the motor protection system must be set according to the operating temperatures indicated in Table 6.4.*

## 6.11. RESISTANCE TEMPERATURE DETECTORS (PT-100)

The thermocouples Pt-100 are made of materials, whose resistance depends on the temperature variation, intrinsic property of some materials (usually platinum, nickel or copper), calibrated resistance. Its operation is based on the principle that the electric resistance of a metallic conductor varies linearly with the temperature, thus allowing a continuous monitoring of the motor warm-up through the controller display ensuring a high level of precision and answer stability. These devices are widely used for measuring temperatures in various industry sectors.
In general these devices are used in installations where precise temperature control is required, for example, in installation for irregular or intermittent duty.
The same detector may be used for alarm and tripping purposes.

Table 6.5 and Figure 6.16 show the equivalence between the Pt-100 resistance and the temperature.

***Table 6.5** - Equivalence between the Pt-100 resistance and the temperature*

| °C | Ω | °C | Ω | °C | Ω | °C | Ω | °C | Ω |
|---|---|---|---|---|---|---|---|---|---|
| -29 | 88.617 | 17 | 106.627 | 63 | 124.390 | 109 | 141.908 | 155 | 159.180 |
| -28 | 89.011 | 18 | 107.016 | 64 | 124.774 | 110 | 142.286 | 156 | 159.553 |
| -27 | 89.405 | 19 | 107.404 | 65 | 125.157 | 111 | 142.664 | 157 | 159.926 |
| -26 | 89.799 | 20 | 107.793 | 66 | 125.540 | 112 | 143.042 | 158 | 160.298 |
| -25 | 90.193 | 21 | 108.181 | 67 | 125.923 | 113 | 143.420 | 159 | 160.671 |
| -24 | 90.587 | 22 | 108.570 | 68 | 126.306 | 114 | 143.797 | 160 | 161.043 |
| -23 | 90.980 | 23 | 108.958 | 69 | 126.689 | 115 | 144.175 | 161 | 161.415 |
| -22 | 91.374 | 24 | 109.346 | 70 | 127.072 | 116 | 144.552 | 162 | 161.787 |
| -21 | 91.767 | 25 | 109.734 | 71 | 127.454 | 117 | 144.930 | 163 | 162.159 |
| -20 | 92.160 | 26 | 110.122 | 72 | 127.837 | 118 | 145.307 | 164 | 162.531 |
| -19 | 92.553 | 27 | 110.509 | 73 | 128.219 | 119 | 145.684 | 165 | 162.903 |
| -18 | 92.946 | 28 | 110.897 | 74 | 128.602 | 120 | 146.061 | 166 | 163.274 |
| -17 | 93.339 | 29 | 111.284 | 75 | 128.984 | 121 | 146.438 | 167 | 163.646 |
| -16 | 93.732 | 30 | 111.672 | 76 | 129.366 | 122 | 146.814 | 168 | 164.017 |
| -15 | 94.125 | 31 | 112.059 | 77 | 129.748 | 123 | 147.191 | 169 | 164.388 |
| -14 | 94.517 | 32 | 112.446 | 78 | 130.130 | 124 | 147.567 | 170 | 164.760 |
| -13 | 94.910 | 33 | 112.833 | 79 | 130.511 | 125 | 147.944 | 171 | 165.131 |
| -12 | 95.302 | 34 | 113.220 | 80 | 130.893 | 126 | 148.320 | 172 | 165.501 |
| -11 | 95.694 | 35 | 113.607 | 81 | 131.274 | 127 | 148.696 | 173 | 165.872 |
| -10 | 96.086 | 36 | 113.994 | 82 | 131.656 | 128 | 149.072 | 174 | 166.243 |
| -9 | 96.478 | 37 | 114.380 | 83 | 132.037 | 129 | 149.448 | 175 | 166.613 |
| -8 | 96.870 | 38 | 114.767 | 84 | 132.418 | 130 | 149.824 | 176 | 166.984 |
| -7 | 97.262 | 39 | 115.153 | 85 | 132.799 | 131 | 150.199 | 177 | 167.354 |
| -6 | 97.653 | 40 | 115.539 | 86 | 133.180 | 132 | 150.575 | 178 | 167.724 |
| -5 | 98.045 | 41 | 115.925 | 87 | 133.561 | 133 | 150.950 | 179 | 168.095 |
| -4 | 98.436 | 42 | 116.311 | 88 | 133.941 | 134 | 151.326 | 180 | 168.465 |
| -3 | 98.827 | 43 | 116.697 | 89 | 134.322 | 135 | 151.701 | 181 | 168.834 |
| -2 | 99.218 | 44 | 117.083 | 90 | 134.702 | 136 | 152.076 | 182 | 169.204 |
| -1 | 99.609 | 45 | 117.469 | 91 | 135.083 | 137 | 152.451 | 183 | 169.574 |
| 0 | 100.000 | 46 | 117.854 | 92 | 135.463 | 138 | 152.826 | 184 | 169.943 |
| 1 | 100.391 | 47 | 118.240 | 93 | 135.843 | 139 | 153.200 | 185 | 170.313 |
| 2 | 100.781 | 48 | 118.625 | 94 | 136.223 | 140 | 153.575 | 186 | 170.682 |
| 3 | 101.172 | 49 | 119.010 | 95 | 136.603 | 141 | 153.950 | 187 | 171.051 |
| 4 | 101.562 | 50 | 119.395 | 96 | 136.982 | 142 | 154.324 | 188 | 171.420 |
| 5 | 101.953 | 51 | 119.780 | 97 | 137.362 | 143 | 154.698 | 189 | 171.789 |
| 6 | 102.343 | 52 | 120.165 | 98 | 137.741 | 144 | 155.072 | 190 | 172.158 |
| 7 | 102.733 | 53 | 120.550 | 99 | 138.121 | 145 | 155.446 | 191 | 172.527 |
| 8 | 103.123 | 54 | 120.934 | 100 | 138.500 | 146 | 155.820 | 192 | 172.895 |
| 9 | 103.513 | 55 | 121.319 | 101 | 138.879 | 147 | 156.194 | 193 | 173.264 |
| 10 | 103.902 | 56 | 121.703 | 102 | 139.258 | 148 | 156.568 | 194 | 173.632 |
| 11 | 104.292 | 57 | 122.087 | 103 | 139.637 | 149 | 156.941 | 195 | 174.000 |
| 12 | 104.681 | 58 | 122.471 | 104 | 140.016 | 150 | 157.315 | 196 | 174.368 |
| 13 | 105.071 | 59 | 122.855 | 105 | 140.395 | 151 | 157.688 | 197 | 174.736 |
| 14 | 105.460 | 60 | 123.239 | 106 | 140.773 | 152 | 158.061 | 198 | 175.104 |
| 15 | 105.849 | 61 | 123.623 | 107 | 141.152 | 153 | 158.435 | 199 | 175.472 |
| 16 | 106.238 | 62 | 124.007 | 108 | 141.530 | 154 | 158.808 | 200 | 175.840 |

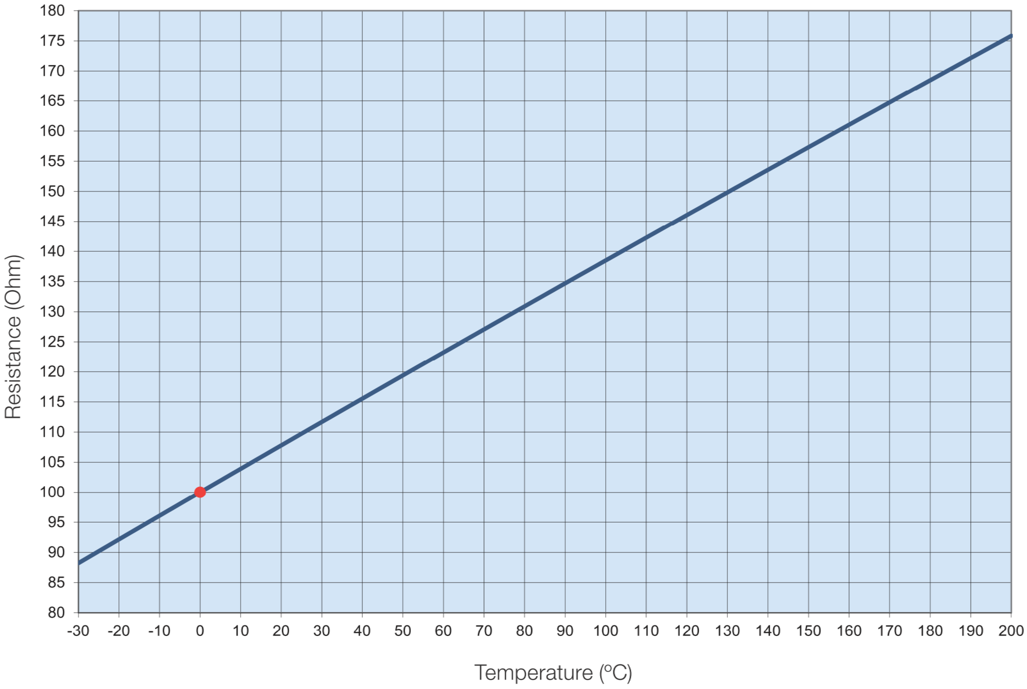


***Figure 6.16*** *- Ohmic resistance of the Pt-100 x temperature*

## 6.12. CONNECTION OF THE SPACE HEATERS

Before switching ON the space heaters, check if the space heaters connection have been made according to the connection diagram shown on the space heater nameplate. For motors supplied with dual voltage space heaters (110-127/220-240 V), see Figure 6.17.

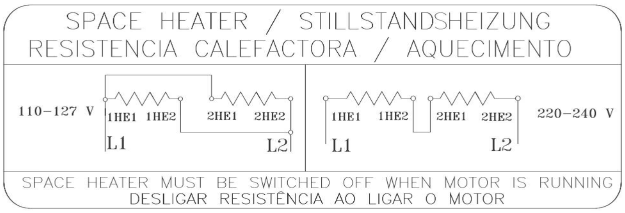

SPACE HEATER / STILLSTANDSHEIZUNG
RESISTENCIA CALEFACTORA / AQUECIMENTO
110–127 V
1HE1
1HE2
2HE1
2HE2
L1
L2
1HE1
1HE2
2HE1
2HE2
L1
L2
220–240 V
SPACE HEATER MUST BE SWITCHED OFF WHEN MOTOR IS RUNNING
DESLIGAR RESISTÊNCIA AO LIGAR O MOTOR

***Figure 6.17*** *- Dual voltage space heater connection*

The space heaters should never be energized when the motor is in operation.

Resistência (Ohm)

**Temperatura (°C)**

## 6.13. STARTING METHODS

Whenever possible, the motor starting must be Direct On Line (DOL) at rated voltage. This is the most simple and feasible starting method. However, it must only be applied when the starting current does not affect the power supply. Please consider the local electric utility regulations when installing a motor.
High inrush current may result in:
a) high voltage drop in the power supply line creating unacceptable line disturbance on the distribution system;
b) requiring oversized protection system (cables and contactor) increasing the installation costs.

If DOL starting is not allowed due to the reasons mentioned above, an indirect starting method compatible with the load and motor voltage to reduce the starting current may be used.
If reduced voltage starters are used for starting, the motor starting torque will also be reduced.

Table 6.6 shows the possible indirect starting methods that can be used depending on the number of the motor leads.

***Table 6.6*** *- Starting method x number of motor leads*

| Number of leads | Possible starting methods |
|---|---|
| 3 leads | Autotransformer<br>Soft-starter |
| 6 leads | Star-Delta<br>Autotransformer<br>Soft-starter |
| 9 leads | Series/Parallel<br>Part winding<br>Autotransformer<br>Soft-starter |
| 12 leads | Star-Delta<br>Series/Parallel<br>Part winding<br>Autotransformer<br>Soft-starter |

Table 6.7 shows examples of possible indirect starting methods to be used according to the voltage indicated on the motor nameplate and the power supply voltage.

***Table 6.7*** *- Starting methods x voltage*

| Nameplate voltage | Operating voltage | Star-delta | Autotransformer starting | Starting by series/ parallel switch | Part-winding starting | Starting by Soft-starter |
|---|---|---|---|---|---|---|
| 220/380 V | 220 V<br>380 V | YES<br>NO | YES<br>YES | NO<br>NO | NO<br>NO | YES<br>YES |
| 220/440 V | 220 V<br>440 V | NO<br>NO | YES<br>YES | YES<br>NO | YES<br>NO | YES<br>YES |
| 230/460 V | 230 V<br>460 V | NO<br>NO | YES<br>YES | YES<br>NO | YES<br>NO | YES<br>YES |
| 380/660 V | 380 V | YES | YES | NO | NO | YES |
| 220/380/440 V | 220 V<br>380 V<br>440 V | YES<br>NO<br>YES | YES<br>YES<br>YES | YES<br>YES<br>NO | YES<br>YES<br>NO | YES<br>YES<br>YES |

⚠ The WQuattro line motors must be started direct on-line (DOL) or driven by a frequency inverter in scalar mode.

## 6.14. MOTORS DRIVEN BY FREQUENCY INVERTER

The operation with frequency inverter must be stated in the Purchase Order since this drive type may require some changes of the motor design.

Wmagnet Motors must only be driven by WEG frequency inverter.

The frequency inverter used to drive motors up to 690 V must be fitted with Pulse With Modulation (PWM) with vector control.

When a motor is driven by a frequency inverter at lower frequencies than the rated frequency, you must reduce the motor torque to prevent motor overheating. The torque reduction (derating torque) can be found in the item 6.4 of the “Technical Guidelines for Induction Motors driven by PWM Frequency inverters” available on the site www.weg.net.

If the motor is operated above the rated frequency, please note:
- That the motor must be operated at constant output;
- That the motor can supply max. 95% of its rated output;
- Do not exceed the maximum speed and please consider:
  - max. operating frequency stated on the additional nameplate;
  - mechanical speed limitation of the motor.

Information on the selection of the power cables between the frequency inverter and the motor can be found in the item 6.4 of the “Technical Guidelines for Induction Motors driven by PWM Frequency inverters” available at www.weg.net.

### 6.14.1. Use of dV/dt filter

### 6.14.1.1. Motor with enameled round wire

Motors designed for rated voltages up to 690 V, when driven by frequency inverter, do not require the use of dV/dT filters, provided that following criteria are considered.

| Criteria for the selection of motors with round enameled wire when driven by frequency inverter [1] | | | | |
|---|---|---|---|---|
| **Motor rated votage [2]** | **Peak voltage at the motor terminals (max)** | **dV/dt inverter output (max)** | **Inverter Rise Time [3] (min.)** | **MTBP [3] Time between pulses (min)** |
| Vnom ≤ 460 V | ≤ 1600 V | ≤ 5200 V/µs | ≥ 0,1 µs | ≥ 6 µs |
| 460 < Vnom ≤ 575 V | ≤ 1800 V | ≤ 6500 V/µs | | |
| 575 < Vnom ≤ 690 V [4] | ≤ 1600 V | ≤ 5200 V/µs | | |
| 575 < Vnom ≤ 690 V [5] | ≤ 2200 V | ≤ 7800 V/µs | | |

***Notes**:*
*1. For the application of motors with round enameled wires designed for 690 < Vnom ≤ 1100 V, please contact WEG.*
*2. For the application of dual voltage motors, example 380/660 V, consider the lower voltage (380 V).*
*3. Information supplied by the inverter manufacturer.*
*4. When not stated in the Purchase Order that the motor will be driven by frequency inverter.*
*5. When stated in the Purchase Order that the motor will be driven by frequency inverter.*

### 6.14.1.2. Motor with prewound coils

Motors with prewound coils (medium and high voltage motors regardless of frame sizes, and low voltage motors from IEC 500 / NEMA 800 frame on), designed for the use with frequency inverters, do not require the use of filters, provided they comply with the criteria in Table 6.8.

***Table 6.8** - Criteria to be considered when using motor with prewound coils to be drive by frequency inverters*

| **Motor rated voltage** | **Type of modulation** | **Turn to turn insulation (phase-phase)** | | **Phase-ground insulation** | |
|---|---|---|---|---|---|
| | | **Peak voltage at the motor terminals** | **dV/dt at the motor terminals** | **Peak voltage at the motor terminals** | **dV/dt at the motor terminals** |
| 690 < Vnom ≤ 4160 V | Sinusoidal | ≤ 5900 V | ≤ 500 V/µs | ≤ 3400 V | ≤ 500 V/µs |
| | PWM | ≤ 9300 V | ≤ 2700 V/µs | ≤ 5400 V | ≤ 2700 V/µs |
| 4160 < Vnom ≤ 6600 V | Sinusoidal | ≤ 9300 V | ≤ 500 V/µs | ≤ 5400 V | ≤ 500 V/µs |
| | PWM | ≤ 14000 V | ≤ 1500 V/µs | ≤ 8000 V | ≤ 1500 V/µs |

## 6.14.2. Bearing insulation

Only the motors in IEC frame size 400 (NEMA 680) and larger are supplied, as standard, with insulated bearing. If motor must be driven by frequency inverter, insulate the bearing according to Table 6.9.

***Table 6.9*** *- Recommendation on the bearing insulation for inverter driven motors*

| Frame size | Recommendation |
|---|---|
| IEC 315 and 355<br>NEMA 445/7 to L5810/11 | ■ Insulated bearing/end shield<br>■ Grounding between shaft and frame by grounding brush |
| IEC 400 and larger<br>NEMA 680 and larger | ■ Insulated NDE bearing<br>■ Grounding between shaft and frame by grounding brush |

When motors are supplied with shaft grounding system, monitor the grounding brush constantly during its operation and, when it reaches the end of its useful life, it must be replaced by another brush with the same specification.

## 6.14.3. Switching frequency

The minimum inverter switching frequency must not be lower than 2.5 kHz and should not exceed 5 kHz.

The non-compliance with the criteria and recommendations indicated in this manual may void the product warranty.

## 6.14.4. Mechanical speed limitation

Table 6.10 shows the maximum speeds allowed for motors driven by frequency inverter.

***Table 6.10*** *- Maximum motor speed (in rpm)*

| Frame size | | DE-bearing | Maximum speed for standard motors |
|---|---|---|---|
| IEC | NEMA | | |
| 63-90 | 143/5 | 6201<br>6202<br>6203<br>6204<br>6205 | 10400 |
| 100 | - | 6206 | 8800 |
| 112 | 182/4 | 6207 | 7600 |
| | | 6307 | 6800 |
| 132 | 213/5 | 6308 | 6000 |
| 160 | 254/6 | 6309 | 5300 |
| 180 | 284/6 | 6311 | 4400 |
| 200 | 324/6 | 6312 | 4200 |
| 225-630 | 364/5-9610 | 6314 | 3600 |
| | | 6315 | 3600 |
| | | 6316 | 3200 |
| | | 6319 | 3000 |
| | | 6218 | 3600 |
| | | 6220 | 3600 |
| | | 6320 | 2200 |
| | | 6322 | 1900 |
| | | 6324 | 1800 |
| | | 6328 | 1800 |
| | | 6330 | 1800 |
| | | 6224 | 1800 |
| | | 6228 | 1800 |

***Note****:*
*To select the maximum allowed motor speed, consider the motor torque derating curve.*

For more information on the application of frequency inverters, contact WEG or check the “Technical Guidelines for Induction Motors driven by PWM Frequency inverters” available at www.weg.net.

# 7. COMMISSIONING

## 7.1. INITIAL START-UP

After finishing the installation procedures and before starting the motor for the first time or after a long period without operation, the following items must be checked:

- If the nameplate data (voltage, current, connection diagram, degree of protection, cooling system, service factor, etc.) meet the application requirements;
- If the machine set (motor + driven machine) has been mounted and aligned correctly;
- If the motor driving system ensures that the motor speed does not exceed the max. allowed speed indicated in Table 6.10;
- Measure the winding insulation resistance, making sure it complies with the specified values in item 5.4;
- Check the motor rotation direction;
- Inspect the motor terminal box for damage and ensure that it is clean and dry and all contacts are rust-free, the seals are in perfect operating conditions and all unused threaded holes are properly closed thus ensuring the degree of protection indicated on the motor nameplate;
- Check if the motor wiring connections, including grounding and auxiliary equipment connection, have been carried out properly and are in accordance with the recommendations in item 6.9;
- Check the operating conditions of the installed auxiliary devices (brake, encoder, thermal protection device, forced cooling system, etc.);
- Check bearing operating conditions. If signs of oxidation are detected, replace the bearings. If no sign of oxidation is detected, relubricate the bearings as described in item 8.2. If the motors are stored for more than two years, the bearings must be replaced before starting the motor;
- For roller bearing motors with oil lubrication, ensure:
  - The oil level should be in the center of the sight glass (see Figure 8.1 and 8.2);
  - That if the motor is stored for a period equal or longer than the oil change interval, the oil must be changed before starting the motor.
- When motors are fitted with sleeve bearings, ensure:
  - Correct oil level for the sleeve bearing. The oil level should be in the center of the sight glass (see Figure 8.3);
  - That the motor is not started or operated with axial or radial loads;
  - That if the motor is stored for a period equal or longer than the oil change interval, the oil must be changed before starting the motor.
- Inspect the capacitor operating condition, if any. If motors are installed for more than two years, but were never commissioned, it is recommended to change the start capacitors since they lose their operating characteristics;
- Ensure that the air inlet and outlet opening are not blocked. The minimum clearance to the nearest wall (L) should be at least ¼ of the fan cover diameter (D), see Figure 7.1. The intake air temperature must be at ambient temperature.

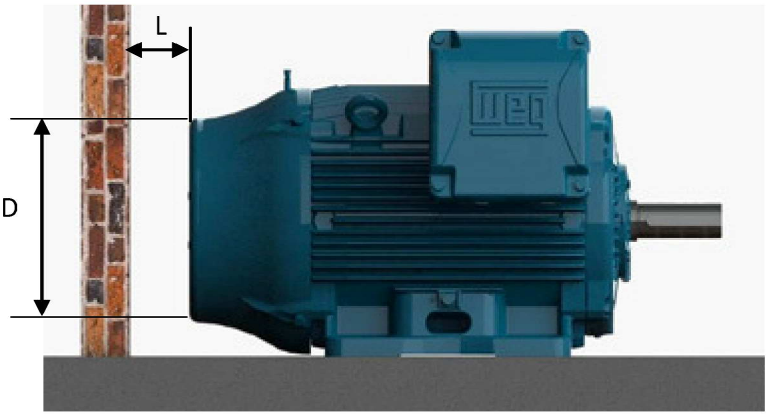


***Figure 7.1***- *Minimum clearance to the wall*

Please consider the minimum distances shown in the Table 7.1 as reference value;

***Table 7.1*** *- Minimum distance between the fan cover and wall*

| **Frame size** | | **Distance between the fan cover and the wall (L)** | |
|---|---|---|---|
| **IEC** | **NEMA** | **mm** | **inches** |
| 63 | - | 25 | 0.96 |
| 71 | - | 26 | 1.02 |
| 80 | - | 30 | 1.18 |
| 90 | 143/5 | 33 | 1.30 |
| 100 | - | 36 | 1.43 |
| 112 | 182/4 | 41 | 1.61 |
| 132 | 213/5 | 50 | 1.98 |
| 160 | 254/6 | 65 | 2.56 |
| 180 | 284/6 | 68 | 2.66 |
| 200 | 324/6 | 78 | 3.08 |
| 225<br>250 | 364/5<br>404/5 | 85 | 3.35 |
| 280 | 444/5<br>445/7<br>447/9 | 108 | 4.23 |
| 315 | L447/9<br>504/5<br>5006/7/8<br>5009/10/11 | 122 | 4.80 |
| 355 | 586/7<br>588/9<br>5807/8/9<br>5810/11/12 | 136 | 5.35 |
| 400 | 6806/7/8<br>6809/10/11 | 147 | 5.79 |
| 450 | 7006/10 | 159 | 6.26 |
| 500 | 8006/10 | 171 | 6.73 |
| 560 | 8806/10 | 185 | 7.28 |
| 630 | 9606/10 | 200 | 7.87 |

- Ensure correct water flow rate and water temperature when water cooled motors are used. See item 7.2;
- Ensure that all rotating parts, such as pulleys, couplings, external fans, shaft, etc. are protected against accidental contact.

Other tests and inspections not included in the manual may be required, depending on the specific installation, application and/or motor characteristics.

After all previous inspections have been carried out, proceed as follows to start the motor:

- Start the motor on no-load (if possible) and check the motor direction of rotation. Check for the presence of any abnormal noise, vibration or other abnormal operating conditions;
- Ensure the motor starts smoothly. If any abnormal operating condition is noticed, switch off the motor, check the assembly system and connections before the motor is started again;
- If excessive vibrations are noticed, check if the motor mounting bolts are well tightened or if the vibrations are not generated and transmitted from adjacent installed equipment. Check the motor vibration periodically and ensure that the vibration limits are as specified in item 7.2.1;
- Start the motor at rated load during a short time and compare the operating current with the rated current indicated on the nameplate;
- Continue to measure the following motor variables until thermal equilibrium is reached: current, voltage, bearing and motor frame temperature, vibration and noise levels;
- Record the measured current and voltage values on the Installation Report for future comparisons.

As induction motors have high inrush currents during start-up, the acceleration of high inertia load requires an extended starting time to reach full speed resulting in fast motor temperature rise. Successive starts within short intervals will result in winding temperature increases and can lead to physical insulation damage reducing the useful life of the insulation system. If the duty cycle S1 / CONT. is specified on the motor nameplate, this means that the motor has been designed for:

- Two successive starts: first start from cold condition, i. e., the motor windings are at room temperature and the second start immediately after the motor stops;
- One start from hot condition, i. e., the motor windings are at rated temperature.

The Troubleshooting Chart in section 10 provides a basic list of unusual cases that may occur during motor operation with the respective corrective actions.

## 7.2. OPERATING CONDITIONS

Unless otherwise stated in the Purchase Order, electric motors are designed and built to be operated at altitudes up to 1000 meters above sea level and in a temperature range from -20 °C to +40 °C. Any deviation from the normal condition of motor operation must be stated on the motor nameplate. Some components must be changed if the ambient temperature is different from the specified one. Please contact WEG to check the required special features.

For operating temperatures and altitudes differing from those above, the factors indicated in Table 7.2 must be applied to the nominal motor power rating in order to determine the derated available output (Pmax = Pnom x correction factor).

***Table 7.2*** *- Correction factors for altitude and ambient temperature*

| T (°C) | Altitude (m) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 |
| 10 | | | | | | | 0.97 | 0.92 | 0.88 |
| 15 | | | | | | 0.98 | 0.94 | 0.90 | 0.86 |
| 20 | | | | | 1.00 | 0.95 | 0.91 | 0.87 | 0.83 |
| 25 | | | | 1.00 | 0.95 | 0.93 | 0.89 | 0.85 | 0.81 |
| 30 | | | 1.00 | 0.96 | 0.92 | 0.90 | 0.86 | 0.82 | 0.78 |
| 35 | | 1.00 | 0.95 | 0.93 | 0.90 | 0.88 | 0.84 | 0.80 | 0.75 |
| 40 | 1.00 | 0.97 | 0.94 | 0.90 | 0.86 | 0.82 | 0.80 | 0.76 | 0.71 |
| 45 | 0.95 | 0.92 | 0.90 | 0.88 | 0.85 | 0.81 | 0.78 | 0.74 | 0.69 |
| 50 | 0.92 | 0.90 | 0.87 | 0.85 | 0.82 | 0.80 | 0.77 | 0.72 | 0.67 |
| 55 | 0.88 | 0.85 | 0.83 | 0.81 | 0.78 | 0.76 | 0.73 | 0.70 | 0.65 |
| 60 | 0.83 | 0.82 | 0.80 | 0.77 | 0.75 | 0.73 | 0.70 | 0.67 | 0.62 |
| 65 | 0.79 | 0.76 | 0.74 | 0.72 | 0.70 | 0.68 | 0.66 | 0.62 | 0.58 |
| 70 | 0.74 | 0.71 | 0.69 | 0.67 | 0.66 | 0.64 | 0.62 | 0.58 | 0.53 |
| 75 | 0.70 | 0.68 | 0.66 | 0.64 | 0.62 | 0.60 | 0.58 | 0.53 | 0.49 |
| 80 | 0.65 | 0.64 | 0.62 | 0.60 | 0.58 | 0.56 | 0.55 | 0.48 | 0.44 |

Motors installed inside enclosures (cubicles) must be ensured an air renewal rate in the order of one cubic meter per second for each 100 kW installed power or fraction of installed power. Totally Enclosed Air Over motors - TEAO (fan and exhaust / smoke extraction) are supplied without cooling fan and the manufacturer of the driven machine is responsible for sufficient motor cooling. If no minimum required air speed between motor fins is indicated on the motor nameplate, ensure the air speed indicated in the table 7.3 is provided. The values shown in Table 7.3 are valid for 60 Hz motors. To obtain the minimum air speed for 50 Hz motors, multiply the values in the table by 0.83.

***Table 7.3*** *- Minimum required air speed between motor fins (metres/second)*

| **Frame** | | **Poles** | | | |
|---|---|---|---|---|---|
| **IEC** | **NEMA** | **2** | **4** | **6** | **8** |
| 63 to 90 | 143/5 | 14 | 7 | 5 | 4 |
| 100 to 132 | 182/4 to 213/5 | 18 | 10 | 8 | 6 |
| 160 to 200 | 254/6 to 324/6 | 20 | 20 | 12 | 7 |
| 225 to 280 | 364/5 to 444/5 | 22 | 22 | 18 | 12 |
| 315 to 355 | 445/7 to 588/9 | 25 | 25 | 20 | 15 |

The voltage and frequency variations may affect the performance characteristics and the electromagnetic compatibility of the motor. The power supply variations should not exceed the values specified in the applicable standards. Examples:

- ABNT NBR 17094 - Parts 1 and 2. The motor has been designed to supply the rated torque for a combined variation in voltage and frequency:
  - Zone A: ±5% of the rated voltage and ±2% of the rated frequency;
  - Zone B: ±10% of the rated voltage and +3% -5% of the rated frequency.

When operated continuously in Zone A or B, the motor may show performance variations and the operating temperature may increase considerably. These performance variations will be higher in Zone B. Thus it is not recommended to operate the motor in Zone B during extended periods.

- IEC 60034-1. The motor has been designed to supply the rated torque for combined variation in voltage and frequency:
  - Zone A: ±5% of the rated voltage and ±2% of the rated frequency;
  - Zone B: ±10% of the rated voltage and +3% -5% of the rated frequency.

When operated continuously in Zone A or B, the motor may show performance variations and the operating temperature may increase considerably. These performance variations will be higher in Zone B. Thus it is not recommended to operate the motor in Zone B during extended periods. For multivoltage motors (example 380-415/660 V), a ±5% voltage variation from the rated voltage is allowed.

- NEMA MG 1 Part 12. The motor has been designed to be operated in one of the following variations:
  - ±10% of the rated voltage, with rated frequency;
  - ±5% of the rated frequency, with rated voltage;
  - A combined variation in voltage and frequency of ±10%, provided the frequency variation does not exceed ±5%.

If the motor is cooled by ambient air, clean the air inlet and outlet openings and cooling fins at regular intervals to ensure a free airflow over the frame surface. The hot air should never be returned to the motor. The cooling air must be at room temperature limited to the temperature range indicated on the motor nameplate (if no room temperature is specified, please consider a temperature range between -20 °C and +40 °C).

Table 7.4 shows the minimum required water flow for water cooled motors considering the different frame sizes and the maximum allowed temperature rise of the cooling water after circulating through the motor. The inlet water temperature should not exceed 40 °C.

***Table 7.4*** *- Minimum required water flow and the maximum allowed temperature rise of the cooling water after circulating through the motor*

| **Frame size** | | **Flow rate (litres/minute)** | **Maximum allowed water temperature rise (°C)** |
|---|---|---|---|
| **IEC** | **NEMA** | | |
| 180 | 284/6 | 12 | 5 |
| 200 | 324/6 | 12 | 5 |
| 225 | 364/5 | 12 | 5 |
| 250 | 404/5 | 12 | 5 |
| 280 | 444/5<br>445/7<br>447/9 | 15 | 6 |
| 315 | 504/5 | 16 | 6 |
| 355 | 586/7<br>588/9 | 25 | 6 |

Motors fitted with oil mist lubrication systems can be operated continuously for a maximum of one hour after the failure of the oil pumping system.

Considering the sun's heat increases the operating temperature, externally mounted motors should always be protected from direct sunlight exposure.

Each and every deviation from the normal operating condition (tripping of the thermal protection, noise and vibration level increase, temperature and current rise) should be investigated and corrected by WEG Authorized Service Centers.

Motors fitted with cylindrical roller bearings require a minimum radial load to ensure a normal operation. For information regarding the radial preload, please contact WEG.

### 7.2.1.Limits of vibration

The vibration severity is the maximum vibration value measured at all positions and in all directions as recommended in the standard IEC 60034-14. Table 7.5 specifies the limits of the maximum vibrations magnitudes according to standard IEC 60034-14 for shaft heights IEC 56 to 400, for vibrations grades A and B. The vibration severity limits in Table 7.5 are given as RMS values (Root Mean Square values or effective values) of the vibration speed in mm/s measured in free suspension condition.

***Table 7.5*** *- Recommended limits for the vibration severity according to standard IEC 60034-14*

| **Shaft height [mm]** | **$56 \le H \le 132$** | **$132 \le H \le 280$** | **$H > 280$** |
|---|---|---|---|
| **Vibration grade** | **Vibration severity on elastic base [mm/s RMS]** | | |
| A | 1.6 | 2.2 | 2.8 |
| B | 0.7 | 1.1 | 1.8 |

***Notes****:*

*1 - The values in Table 7.5 are valid for measurements carried out with decoupled machines (without load) operated at rated voltage and frequency.*

*2 - The values in Table 7.5 are valid regardless of the direction of rotation of the machine.*

*3 - The values in Table 7.5 are not applicable to single-phase motors, three-phase motors powered by a single-phase system or to machines mounted in situ or coupled with inertia flywheels or to loads.*

According to NEMA MG 1, the allowed vibration limit for standard motors is 0.15 in/s (peak vibration in in/s).

***Note****:*

*For the load operation condition, the use of the standard ISO 10816-3 is recommended for evaluating the motor vibration limits. In the load condition the motor vibration will be influenced by several factors, such as, type of the coupled load, condition of the motor fixation, alignment condition under load, structure or base vibration due to other equipments, etc..*

# 8. MAINTENANCE

The purpose of the maintenance is to extend the useful life of the equipment. The non-compliance with one of these previous items can cause unexpected machine failures.

If motors with cylindrical roller or angular contact bearings are to be transported during the maintenance procedures, the shaft locking device must always be fitted. All HGF motors, regardless of the bearing type, must always be transported with the shaft locking device fitted.

All repairs, disassembly and assembly related services must be carried out only by qualified and well-trained personnel by using proper tools and techniques. Make sure that the machine has stopped and it is disconnected from the power supply, including the accessory devices (space heater, brake, etc.), before any servicing is undertaken.
The company does not assume any responsibility or liability for repair services or maintenance operations executed by non-authorized Service Centers or by non qualified service personnel. The company shall have no obligation or liability whatsoever to the buyer for any indirect, special, consequential or incidental loss or damage caused or arising from the company's proven negligence

## 8.1. GENERAL INSPECTION

The inspection intervals depend on the motor type, application and installation conditions. Proceed as follows during inspection:

- Visually inspect the motor and coupling. Check if abnormal noises, vibrations, excessive heating, wear signs, misalignment or damaged parts are noticed. Replace the damaged parts as required;
- Measure the insulation resistance according to the item 5.4;
- Clean the motor enclosure. Remove oil spills and dust accumulation from the motor frame surface to ensure a better heat transfer to the surrounding ambient;
- Check cooling fan condition and clean the air inlet & outlet openings to ensure a free air flow over the motor;
- Investigate the actual condition of the seals and replace them, if required;
- Drain the condensed water from inside the motor. After draining, reinstall the drain plugs to ensure the degree of protection as indicated on the motor nameplate. The motor must always be positioned so the drain hole is at the lowest position (see item 6);
- Check the connections of the power supply cables, ensuring the correct clearance distance between live and grounded parts, as specified in Table 6.3;
- Check if the tightening torque of the bolted connections and mounting bolts meets the tightening torque specified in Table 8.11;
- Check the status of the cable passages, the cable gland seals and the seals inside the terminal box and replace them, if required;
- Check the bearing operating conditions. Check for the presence of any abnormal noise, vibration or other abnormal operating conditions, like motor temperature rise. Check the oil level, the lube oil condition and compare the workings hours with the informed life time;
- Record and file all changes performed on the motor.

Do not reuse damaged or worn parts. Damaged or worn parts must be replaced by parts supplied by the manufacturer and must be installed as if they were the original parts.

## 8.2. LUBRICATION

Proper lubrication plays a vital role in the motor performance. Only use the grease or oil types, amounts and lubrication intervals recommended for the bearings. This information is available on the motor nameplate and the lubrication procedures must be carried out according to the type of lubricant (oil or grease).
When the motor is fitted with thermal protection devices for bearing temperature control, consider the operating temperature limits shown in Table 6.4.
The maximum operating temperature of motors used in special applications may differ from those shown in Table 6.4. The grease and oil disposal should be made in compliance with applicable laws in each country.

Please contact WEG when motors are to be installed in special environments or used for special applications.

### 8.2.1. Grease lubricated rolling bearings

Excess grease causes bearing overheating, resulting in bearing failure.

The lubrication intervals specified in Table 8.1, Table 8.2, Table 8.3, Table 8.4, Table 8.5, Table 8.6, Table 8.7 and Table 8.8 consider an absolute temperature on the bearing of 70 °C (up to frame size IEC 200 / NEMA 324/6) and 85 °C (for frame size IEC 225 / NEMA 364/5 and above), the motor running at rated speed, a motor mounted in horizontal position and greased with Mobil Polyrex EM grease. Any variation of the parameters listed above must be evaluated.

***Table 8.1*** *- Lubrication intervals for ball bearings*

| **Frame** | | **Poles** | **Bearing designation** | **Amount of grease (g)** | **Lubrication intervals (hours)** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | **ODP (Open Drip Proof)** | | **W21 TEFC (Totally Enclosed Fan Cooled)** | | **W22 TEFC (Totally Enclosed Fan Cooled)** | |
| **IEC** | **NEMA** | | | | **50 Hz** | **60 Hz** | **50 Hz** | **60 Hz** | **50 Hz** | **60 Hz** |
| 90 | 143/5 | 2 | 6205 | 4 | - | - | 20000 | 20000 | 25000 | 25000 |
| | | 4 | | | | | | | | |
| | | 6 | | | | | | | | |
| | | 8 | | | | | | | | |
| 100 | - | 2 | 6206 | 5 | - | - | 20000 | 20000 | 25000 | 25000 |
| | | 4 | | | | | | | | |
| | | 6 | | | | | | | | |
| | | 8 | | | | | | | | |
| 112 | 182/4 | 2 | 6207/<br>6307 | 9 | - | - | 20000 | 20000 | 25000 | 25000 |
| | | 4 | | | | | | | | |
| | | 6 | | | | | | | | |
| | | 8 | | | | | | | | |
| 132 | 213/5 | 2 | 6308 | 11 | - | - | 20000 | 18400 | 25000 | 23200 |
| | | 4 | | | | | 20000 | 20000 | 25000 | 25000 |
| | | 6 | | | | | | | | |
| | | 8 | | | | | | | | |
| 160 | 254/6 | 2 | 6309 | 13 | 20000 | 20000 | 18100 | 15700 | 22000 | 20000 |
| | | 4 | | | | | 20000 | 20000 | 25000 | 25000 |
| | | 6 | | | | | | | | |
| | | 8 | | | | | | | | |
| 180 | 284/6 | 2 | 6311 | 18 | 20000 | 20000 | 13700 | 11500 | 17000 | 14000 |
| | | 4 | | | | | 20000 | 20000 | 25000 | 25000 |
| | | 6 | | | | | | | | |
| | | 8 | | | | | | | | |
| 200 | 324/6 | 2 | 6312 | 21 | 20000 | 20000 | 11900 | 9800 | 15000 | 12000 |
| | | 4 | | | | | 20000 | 20000 | 25000 | 25000 |
| | | 6 | | | | | | | | |
| | | 8 | | | | | | | | |
| 225<br>250<br>280<br>315<br>355 | 364/5<br>404/5<br>444/5<br>445/7<br>447/9<br>L447/9<br>504/5<br>5008<br>5010/11<br>586/7<br>588/9 | 2 | 6314 | 27 | 18000 | 14400 | 4500 | 3600 | 5000 | 4000 |
| | | 4 | | | 20000 | 20000 | 11600 | 9700 | 14000 | 12000 |
| | | 6 | | | | | 16400 | 14200 | 20000 | 17000 |
| | | 8 | | | | | 19700 | 17300 | 24000 | 20000 |
| | | 2 | 6316 | 34 | 14000 | *Upon request | 3500 | *Upon request | 4000 | *Upon request |
| | | 4 | | | 20000 | 20000 | 10400 | 8500 | 13000 | 10000 |
| | | 6 | | | | | 14900 | 12800 | 18000 | 16000 |
| | | 8 | | | | | 18700 | 15900 | 20000 | 20000 |
| | | 2 | 6319 | 45 | *Upon request | | | | | |
| | | 4 | | | 20000 | 20000 | 9000 | 7000 | 11000 | 8000 |
| | | 6 | | | | | 13000 | 11000 | 16000 | 13000 |
| | | 8 | | | | | 17400 | 14000 | 20000 | 17000 |
| | | 4 | 6322 | 60 | 20000 | 20000 | 7200 | 5100 | 9000 | 6000 |
| | | 6 | | | | | 10800 | 9200 | 13000 | 11000 |
| | | 8 | | | | | 15100 | 11800 | 19000 | 14000 |

*Table 8.2* - Lubrication intervals for cylindrical roller bearings

| **Frame** | | **Poles** | **Bearing designation** | **Amount of grease (g)** | **LUBRICATION INTERVALS (hours)** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | **ODP (Open Drip Proof)** | | **W21 TEFC (Totally Enclosed Fan Cooled)** | | **W22 TEFC (Totally Enclosed Fan Cooled)** | |
| **IEC** | **NEMA** | | | | **50 Hz** | **60 Hz** | **50 Hz** | **60 Hz** | **50 Hz** | **60 Hz** |
| 160 | 254/6 | 2 | NU309 | 13 | 20000 | 19600 | 13300 | 9800 | 16000 | 12000 |
| | | 4 | | | | 20000 | 20000 | 20000 | 25000 | 25000 |
| | | 6 | | | | | | | | |
| | | 8 | | | | | | | | |
| 180 | 284/6 | 2 | NU311 | 18 | 18400 | 12800 | 9200 | 6400 | 11000 | 8000 |
| | | 4 | | | 20000 | 20000 | 20000 | 19100 | 25000 | 25000 |
| | | 6 | | | | | | 20000 | | |
| | | 8 | | | | | | | | |
| 200 | 324/6 | 2 | NU312 | 21 | 15200 | 10200 | 7600 | 5100 | 9000 | 6000 |
| | | 4 | | | 20000 | 20000 | 20000 | 17200 | 25000 | 21000 |
| | | 6 | | | | | | 20000 | | 25000 |
| | | 8 | | | | | | | | |
| 225<br>250<br>280<br>315<br>355 | 364/5<br>404/5<br>444/5<br>445/7<br>447/9<br>L447/9<br>504/5<br>5008<br>5010/11<br>586/7<br>588/9 | 4 | NU314 | 27 | 17800 | 14200 | 8900 | 7100 | 11000 | 9000 |
| | | 6 | | | 20000 | 20000 | 13100 | 11000 | 16000 | 13000 |
| | | 8 | | | | | 16900 | 15100 | 20000 | 19000 |
| | | 4 | NU316 | 34 | 15200 | 12000 | 7600 | 6000 | 9000 | 7000 |
| | | 6 | | | 20000 | 19000 | 11600 | 9500 | 14000 | 12000 |
| | | 8 | | | | 20000 | 15500 | 13800 | 19000 | 17000 |
| | | 4 | NU319 | 45 | 12000 | 9400 | 6000 | 4700 | 7000 | 5000 |
| | | 6 | | | 19600 | 15200 | 9800 | 7600 | 12000 | 9000 |
| | | 8 | | | 20000 | 20000 | 13700 | 12200 | 17000 | 15000 |
| | | 4 | NU322 | 60 | 8800 | 6600 | 4400 | 3300 | 5000 | 4000 |
| | | 6 | | | 15600 | 11800 | 7800 | 5900 | 9000 | 7000 |
| | | 8 | | | 20000 | 20000 | 11500 | 10700 | 14000 | 13000 |

*Table 8.3* - Lubrication intervals for ball bearings - HGF line

| **Frame** | | **Poles** | **Bearing designation** | **Amount of grease (g)** | **Lubrication intervals (hours)** | |
|---|---|---|---|---|---|---|
| **IEC** | **NEMA** | | | | **50 Hz** | **60 Hz** |
| 315L/A/B and 315C/D/E | 5006/7/8T and 5009/10/11T | 2 | 6314 | 27 | 3100 | 2100 |
| | | 4 - 8 | 6320 | 50 | 4500 | 4500 |
| | | | 6316 | 34 | 4500 | 4500 |
| 355L/A/B and 355C/D/E | 5807/8/9T and 5810/11/12T | 2 | 6314 | 27 | 3100 | 2100 |
| | | 4 - 8 | 6322 | 60 | 4500 | 4500 |
| | | | 6319 | 45 | 4500 | 4500 |
| 400L/A/B and 400 C/D/E | 6806/7/8T and 6809/10/11T | 2 | 6315 | 30 | 2700 | 1800 |
| | | 4 - 8 | 6324 | 72 | 4500 | 4500 |
| | | | 6319 | 45 | 4500 | 4500 |
| 450 | 7006/10 | 2 | 6220 | 31 | 2500 | 1400 |
| | | 4 | 6328 | 93 | 4500 | 3300 |
| | | | 6322 | 60 | 4500 | 4500 |
| | | 6 - 8 | 6328 | 93 | 4500 | 4500 |
| | | | 6322 | 60 | 4500 | 4500 |
| 500 | 8006/10 | 4 | 6330 | 104 | 4200 | 2800 |
| | | | 6324 | 72 | 4500 | 4500 |
| | | 6 - 8 | 6330 | 104 | 4500 | 4500 |
| | | | 6324 | 72 | 4500 | 4500 |
| 500 | 8006/10 | 4 | 6330 | 104 | 4200 | 2800 |
| | | | 6324 | 72 | 4500 | 4500 |
| | | 6 - 8 | 6330 | 104 | 4500 | 4500 |
| | | | 6324 | 72 | 4500 | 4500 |
| 560 | 8806/10 | 4 - 8 | *Upon request | | | |
| 630 | 9606/10 | 4 - 8 | | | | |

***Table 8.4*** *- Lubrication intervals for cylindrical roller bearings - HGF line*

| **Frame** | | **Poles** | **Bearing designation** | **Amount of grease (g)** | **Lubrication intervals (hours)** | |
|---|---|---|---|---|---|---|
| **IEC** | **NEMA** | | | | **50 Hz** | **60 Hz** |
| 315L/A/B and 315C/D/E | 5006/7/8 and 5009/10/11 | 4 | NU320 | 50 | 4300 | 2900 |
| | | 6 - 8 | | | 4500 | 4500 |
| 355L/A/B and 355C/D/E | 5807/8/9 and 5810/11/12 | 4 | NU322 | 60 | 3500 | 2200 |
| | | 6 - 8 | | | 4500 | 4500 |
| 400L/A/B and 400C/D/E | 6806/7/8 and 6809/10/11 | 4 | NU324 | 72 | 2900 | 1800 |
| | | 6 - 8 | | | 4500 | 4500 |
| 450 | 7006/10 | 4 | NU328 | 93 | 2000 | 1400 |
| | | 6 | | | 4500 | 3200 |
| | | 8 | | | 4500 | 4500 |
| 500 | 8006/10 | 4 | NU330 | 104 | 1700 | 1000 |
| | | 6 | | | 4100 | 2900 |
| | | 8 | | | 4500 | 4500 |
| 560 | 8806/10 | 4 | NU228 + 6228 | 75 | 2600 | 1600 |
| | | 6 - 8 | | 106 | 4500 | 4500 |
| 630 | 9606/10 | 4 | NU232 + 6232 | 92 | 1800 | 1000 |
| | | 6 | | 120 | 4300 | 3100 |
| | | 8 | | 140 | 4500 | 4500 |

***Tabela 8.5*** *- Lubrication intervals for ball bearings - W50 line*

| | **Frame** | | **Poles** | **D.E. Bearing** | **Amount of grease (g)** | **50 Hz (h)** | **60 Hz (h)** | **N.D.E. Bearing** | **Amount of grease (g)** | **50 Hz (h)** | **60 Hz (h)** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **IEC** | **NEMA** | | | | | | | | | |
| **Horizontal mounting Ball bearings** | 315 H/G | 5009/10 | 2 | 6314 | 27 | 4500 | 3500 | 6314 | 27 | 4500 | 3500 |
| | | | 4 - 8 | 6320 | 50 | | 4500 | 6316 | 34 | | 4500 |
| | 355 J/H | 5809/10 | 2 | 6314 | 27 | | 3500 | 6314 | 27 | | 3500 |
| | | | 4 - 8 | 6322 | 60 | | 4500 | 6319 | 45 | | 4500 |
| | 400 L/K and 400 J/H | 6806/07 and 6808/09 | 2 | 6218 | 24 | 3800 | 2500 | 6218 | 24 | 3800 | 1800 |
| | | | 4 - 8 | 6324 | 72 | 4500 | 4500 | 6319 | 45 | 4500 | 4500 |
| | 450 L/K and 450 J/H | 7006/07 and 7008/09 | 2 | 6220 | 31 | 3000 | 2000 | 6220 | 31 | 3000 | 2000 |
| | | | 4 | 6328 | 93 | 4500 | 3300 | 6322 | 60 | 4500 | 4500 |
| | | | 6 - 8 | | | | 4500 | | | | |
| **Vertical mounting Ball bearings** | 315 H/G | 5009/10 | 2 | 7314 | 27 | 2500 | 1700 | 6314 | 27 | 2500 | 1700 |
| | | | 4 | 6320 | 50 | 4200 | 3200 | 6316 | 34 | 4500 | 4500 |
| | | | 6 - 8 | | | 4500 | 4500 | | | | |
| | 355 J/H | 5809/10 | 2 | 7314 | 27 | 2500 | 1700 | 6314 | 27 | 2500 | 1700 |
| | | | 4 | 6322 | 60 | 3600 | 2700 | 6319 | 45 | 4500 | 3600 |
| | | | 6 - 8 | | | 4500 | 4500 | | | | 4500 |
| | 400 L/K and 400 J/H | 6806/07 and 6808/09 | 2 | 7218 | 24 | 2000 | 1300 | 6218 | 24 | 2000 | 1300 |
| | | | 4 | 7324 | 72 | 3200 | 2300 | 6319 | 45 | 4500 | 3600 |
| | | | 6 | | | 4500 | 4300 | | | | 4500 |
| | | | 8 | | | | 4500 | | | | |
| | 450 L/K and 450 J/H | 7006/07 and 7008/09 | 2 | 7220 | 31 | 1500 | 1000 | 6220 | 31 | 1500 | 1000 |
| | | | 4 | 7328 | 93 | 2400 | 1700 | 6322 | 60 | 3500 | 2700 |
| | | | 6 | | | 4100 | 3500 | | | 4500 | 4500 |
| | | | 8 | | | 4500 | 4500 | | | | |

***Tabela 8.6*** *- Lubrication intervals for cylindrical roller bearings - W50 line*

| | **Frame** | | **Poles** | **D.E. Bearing** | **Amount of grease (g)** | **50 Hz (h)** | **60 Hz (h)** | **N.D.E. Bearing** | **Amount of grease (g)** | **50 Hz (h)** | **60 Hz (h)** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **IEC** | **NEMA** | | | | | | | | | |
| **Horizontal mounting Roller bearings** | 315 H/G | 5009/10 | 4 | NU320 | 50 | 4300 | 2900 | 6316 | 34 | 4500 | 4500 |
| | | | 6 -8 | | | 4500 | 4500 | | | | |
| | 355 J/H | 5809/10 | 4 | NU322 | 60 | 3500 | 2200 | 6319 | 45 | | |
| | | | 6 - 8 | | | 4500 | 4500 | | | | |
| | 400 L/K and 400 J/H | 6806/07 and 6808/09 | 4 | NU324 | 72 | 2900 | 1800 | | | | |
| | | | 6 - 8 | | | 4500 | 4500 | | | | |
| | 450 L/K and 450 J/H | 7006/07 and 7008/09 | 4 | NU328 | 93 | 2000 | 1400 | 6322 | 60 | | |
| | | | 6 | | | 4500 | 3200 | | | | |
| | | | 8 | | | | 4500 | | | | |

**ENGLISH**

***Tabela 8.7*** *- Lubrication intervals for ball bearings - W40 line*

| | **Frame** | | **Poles** | **D.E. Bearing** | **Amount of grease (g)** | **50 Hz (h)** | **60 Hz (h)** | **N.D.E. Bearing** | **Amount of grease (g)** | **50 Hz (h)** | **60 Hz (h)** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **IEC** | **NEMA** | | | | | | | | | |
| **Horizontal mounting Ball bearings** | 355 J/H | L5010/11 | 2 | 6218 | 24 | 4500 | 4500 | 6218 | 24 | 4500 | 4500 |
| | | | 4 – 8 | 6224 | 43 | 4500 | 4500 | 6218 | 24 | 4500 | 4500 |
| | 400 J/H | L5810/11 | 2 | 6220 | 31 | 4500 | 3800 | 6220 | 31 | 4500 | 3800 |
| | | | 4 – 8 | 6228 | 52 | 4500 | 4500 | 6220 | 31 | 4500 | 4500 |
| | 450 K/J | L6808/09 | 2 | 6220 | 31 | 4500 | 3800 | 6220 | 31 | 4500 | 3800 |
| | | | 4 – 8 | 6228 | 52 | 4500 | 4500 | 6220 | 31 | 4500 | 4500 |

***Tabela 8.8*** *- Lubrication intervals for cylindrical roller bearings - W40 line*

| | **Frame** | | **Poles** | **D.E. Bearing** | **Amount of grease (g)** | **50 Hz (h)** | **60 Hz (h)** | **N.D.E. Bearing** | **Amount of grease (g)** | **50 Hz (h)** | **60 Hz (h)** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **IEC** | **NEMA** | | | | | | | | | |
| **Horizontal mounting Roller bearings** | 355 J/H | L5010/11 | 4 – 8 | NU224 | 43 | 4500 | 4500 | NU218 | 24 | 4500 | 4500 |
| | 400 J/H | L5810/11 | 4 – 8 | NU228 | 52 | 4500 | 3300 | NU220 | 31 | 4500 | 4500 |
| | 450 K/J | L6808/09 | 4 – 8 | NU228 | 52 | 4500 | 3300 | NU220 | 31 | 4500 | 4500 |

For each increment of 15 ºC above the bearing temperature, the relubrication intervals given in the Table must be halved. The relubrication interval of motors designed by the manufacturer for mounting in horizontal position, but installed in vertical position (with WEG authorization), must be halved.
For special applications, such as: high and low temperatures, aggressive environments, driven by frequency inverter (VFD - frequency inverter), etc., please contact WEG about the required amount of grease and the relubrication intervals.

### 8.2.1.1. Motor without grease fitting

Motors without grease fittings must be lubricated in accordance with the existing Maintenance Plan. Motor disassembly must be carried out as specified in Item 8.3. If motors are fitted with shielded bearings (for example, ZZ, DDU, 2RS, VV), these bearings must be replaced at the end of the grease service life.

### 8.2.1.2. Motor with grease fitting

To lubricate the bearings with the motor stopped, proceed as follows:
- Before lubricating, clean the grease nipple and immediate vicinity thoroughly;
- Lift grease inlet protection;
- Remove the grease outlet plug;
- Pump in approximately half of the total grease indicated on the motor nameplate and run the motor for about 1 (one) minute at rated speed;
- Switch-off the motor and pump in the remaining grease;
- Lower again the grease inlet protection and reinstall the grease outlet protection.

To grease the motor while running, proceed as follows:
- Before lubricating, clean the grease nipple and immediate vicinity thoroughly;
- Pump the total grease indicated on the motor nameplate;
- Lower again the grease inlet protection.

⚠ For lubrication, use only manual grease gun.

If Motors are provided with a spring device for grease removal, the grease excess must be removed by pulling the rod and cleaning the spring until the spring does not remove more grease.

### 8.2.1.3. Compatibility of the Mobil Polyrex EM grease with other greases

The Mobil Polyrex EM grease has a polyurea thickener and a mineral oil thus being compatible with greases that contain:

- Lithium based thickener, lithium-based complex thickener, polyurea thickener and refined mineral oil;
- The used grease must have in its formulation corrosion and oxidation inhibitors.

In general terms, greases with the same type of soap are compatible to each other. However, depending on the proportion of the mixture there may be incompatibility. In such a case, it is not recommended to mix different types of greases without contacting the supplier or WEG beforehand.

### 8.2.2. Oil lubricated bearings

To change the oil of oil lubricated motor proceed as follows:

- Switch-off the motor;
- Remove threaded oil drain plug;
- Open the valve and drain the oil;
- Close the drain valve again;
- Reinstall the threaded oil drain plug;
- Fill-up with the type and amount of oil as specified on the nameplate;
- Check oil level. The oil level is OK when the lubricant can be viewed approximately in the center of the sight glass;
- Reinstall oil inlet plug;
- Check for oil leaks and ensure that all not used threaded plugs are closed with plugs.

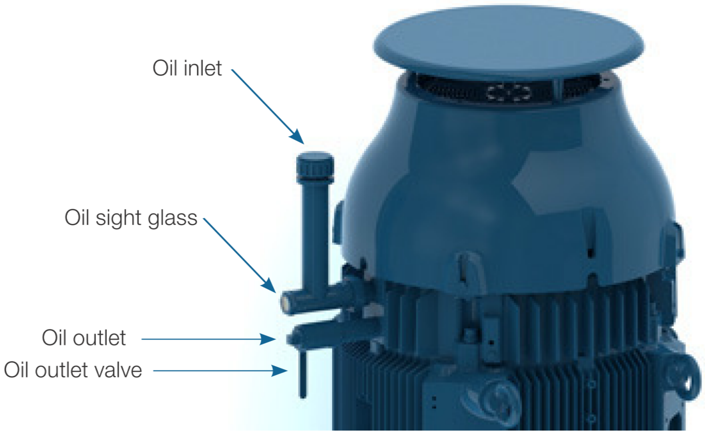


***Figure 8.1*** *- Oil lubricated bearing - vertical mounting*

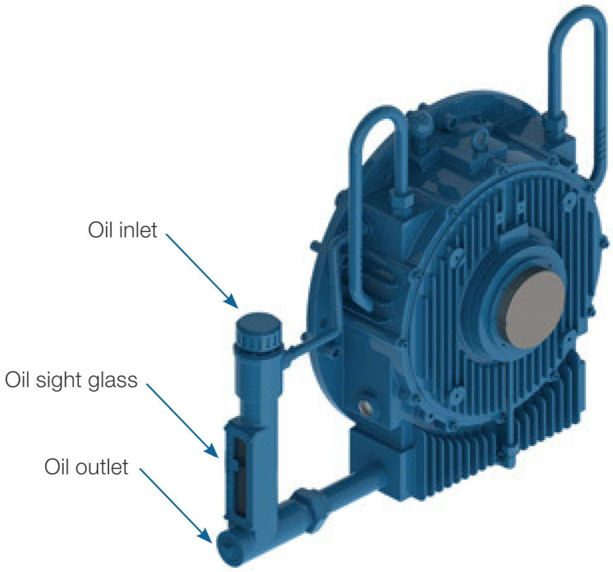


***Figure 8.2*** *- Oil lubricated bearing - horizontal mounting*

The bearing lubricating oil must be replaced as specified on the nameplate or whenever changes in the oil properties are noticed. The oil viscosity and pH must be checked periodically. The oil level must be checked every day and must be kept in the center of the sight glass.

Please contact WEG, when oils with different viscosities should be used.

***Note**:*

*The HGF vertical mounted motors with high axial thrust are supplied with grease lubricated DE-bearings and with oil lubricated NDE-bearings. The DE-bearings must be lubricated according to recommendations in item 8.2.1. Table 8.9 specifies the oil type and the amount of oil required for this motor lubrication.*

***Table 8.9** - Oil properties for HGF vertical mounted motors with high axial thrust*

| **Mounting - high axial thrust** | **Frame** | | **Poles** | **Bearing designation** | **Oil (liters)** | **Interval (h)** | **Lubricant** | **Lubricant specification** |
|---|---|---|---|---|---|---|---|---|
| | **IEC** | **NEMA** | | | | | | |
| | 315L/A/B e<br>315C/D/E | 5006/7/8T e<br>5009/10/11T | 4 - 8 | 29320 | 20 | 8000 | FUCHS Renolin DTA 40 / Mobil SHC 629 | ISO VG150 mineral oil with antifoam and antioxidant additives |
| | 355L/A/B e<br>355C/D/E | 5807/8/9T e<br>5810/11/12T | 4 - 8 | 29320 | 26 | | | |
| | 400L/A/B e<br>400C/D/E | 6806/7/8T e<br>6809/10/11T | 4 - 8 | 29320 | 37 | | | |
| | 450 | 7006/10 | 4 - 8 | 29320 | 45 | | | |

## 8.2.3. Oil mist lubricated bearings

Check the service conditions of the seals and if replacement is required use only original components. Clean the seal components before assembly (bearing caps, end shields, etc.).

Apply joint sealant between the bearing caps and end shields. The joint sealant must be compatible with the used lubricating oil. Connect the oil lubricant tubes (oil inlet and oil outlet tubes and motor drain tube), as shown in Figure 6.12.

## 8.2.4. Sleeve bearings

The lubricating oil of sleeve bearings must be changed at the intervals specified in Table 8.10. To replace the oil, proceed as follows:

- NDE-bearing: remove the protection plate from the fan cover;
- Drain the oil through the drain hole located at the bottom of the bearing (see Figure 8.3);
- Close the oil drain hole;
- Remove the oil inlet plug;
- Fill the sleeve bearing with the specified oil and with the amount of oil specified in;
- Check the oil level and ensure it is kept close to the center of the sight glass;
- Install the oil inlet plug;
- Check for oil leaks.

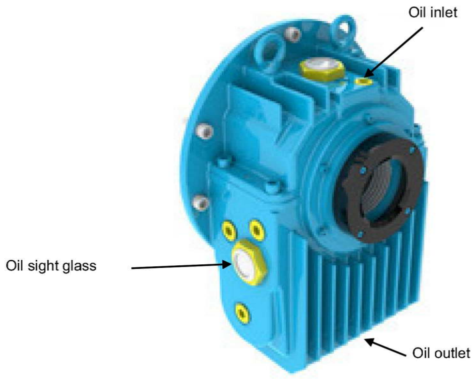


***Figure 8.3 -** Sleeve bearing*

***Table 8.10*** *- Oil properties for sleeve bearings*

| **Frame** | | **Poles** | **Bearing designation** | **Oil (liters)** | **Interval (h)** | **Lubricant** | **Lubricant specification** |
|---|---|---|---|---|---|---|---|
| **IEC** | **NEMA** | | | | | | |
| 315 | 5000 | 2 | 9-80 | 2.8 | 8000 | FUCHS Renolin DTA 10 | ISO VG32 mineral oil with antifoam and antioxidant additives |
| 355 | 5800 | | | | | | |
| 400 | 6800 | | | | | | |
| 450 | 7000 | | | | | | |
| 315 | 5000 | 4 - 8 | 9-90 | 2.8 | 8000 | FUCHS Renolin DTA 15 | ISO VG46 mineral oil with antifoam and antioxidant additives |
| 355 | 5800 | | 9-100 | | | | |
| 400 | 6800 | | 11-110 | 4.7 | | | |
| 450 | 7000 | | 11-125 | | | | |
| 500 | 8000 | | | | | | |

The lubricating oil must be replaced as specified on the nameplate or whenever changes on the oil properties are noticed. The oil viscosity and pH must be checked periodically. The oil level must be checked every day and kept in the center of the sight glass.
Please contact WEG, when oils with different viscosities are to be used.

## 8.3. MOTOR ASSEMBLY AND DISASSEMBLY

All repair services on motors should be always performed by qualified personnel and in accordance with the applicable laws and regulations in each country. Always use proper tools and devices for motor disassembly and assembly.

Disassembly and assembly services can be carried out only after the motor has been disconnected from the power supply and is completely stopped.

Dangerous voltages may be present at the motor terminals inside the terminal box since capacitors can retain electrical charge for long periods of time even when they are not connected directly to a power source or when space heaters are connected to the motor or when the motor windings are used as space heaters. Dangerous voltages may be present at the motor terminals when they are driven by frequency inverter even when they are completely stopped.

Record the installation conditions such as terminal connection diagram, alignment / leveling conditions before starting the disassembly procedures. These records should be considered for later assembly.

Disassemble the motor carefully without causing scratches on machined surfaces or damaging the threads.

Assemble the motor on a flat surface ensuring a good support base. Footless motors must be fixed/locked on the base to prevent accidents.

Handle the motor carefully to not damage the insulated components such as windings, insulated rolling bearings, power cables etc..

Seal elements, such as joint seals and bearing seals should always be replaced when wear or damage is noticed.

Motors with degree of protection higher than IP55 are supplied with joint and screw seal Loctite 5923 (Henkel) Clean the components and apply a new coat of Loctite 5923 on the surfaces before assembly.

### 8.3.1. Terminal box

Proceed as follows to remove the terminal box cover and to disconnect/connect the power supply cables and the cables of the accessory devices:

- Ensure that during the screw removal the terminal box cover does not damage the components installed inside the terminal box;
- If the terminal box cover is fitted with lifting eyebolt, lift the terminal box cover always by its lift eyebolt;
- If motors are supplied with terminal blocks, ensure the correct tightening torque on the motor terminals as specified in Table 8.11;
- Ensure that the cables do not contact sharp edges;
- Ensure that the original IP degree of protection is not changed and is maintained as indicate on the motor nameplate. The power supply cables and the control cables must always be fitted with components (cable glands, conduits) that meet the applicable standards and regulations of each country;
- Ensure that the pressure relief device is in perfect operating condition, if provided. The seals in the terminal box must be in perfect condition for reuse and must be reinstalled correctly to ensure the specified degree of protection;
- Ensure the correct tightening torque for the securing bolts of the terminal box cover as specified in Table 8.11.

***Table 8.11*** *- Tightening torque for the securing bolts [Nm]*

| Screw type and seal | M4 | M5 | M6 | M8 | M10 | M12 | M16 | M20 |
|---|---|---|---|---|---|---|---|---|
| Hex bolt/hex socket bolt (without seal) | - | 4 to 7 | 7 to 12 | 16 to 30 | 30 to 50 | 55 to 85 | 120 to 180 | 230 to 360 |
| Combined slotted screw (without seal) | - | 3 to 5 | 5 to 10 | 10 to 18 | - | - | - | - |
| Hex bolt/hex socket bolt (with seal with metallic stop/cord) | - | - | - | 13 to 20 | 25 to 37 | 40 to 55 | 50 to 65 | - |
| Combined slotted screw (with flat seal 'and/or mettallic stop/cord) | - | 3 to 5 | 4 to 8 | 8 to 15 | - | - | - | - |
| Hex bolt/hex socket bolt (with flat seal) | - | - | - | 8 to 15 | 18 to 30 | 25 to 40 | 35 to 50 | - |
| Terminal blocks | 1 to 1,5 | 1,5 to 4 | 3 to 6,5 | 6 to 9 | 10 to 18 | 15,5 to 30 | 30 to 50 | - |
| Grounding terminals | - | 3 to 5 | 5 to 10 | 10 to 18 | 30 to 50 | 55 to 85 | 120 to 180 | - |

## 8.4. DRYING THE STATOR WINDING INSULATION

Dismantle the motor completely. Remove the end shields, the rotor with the shaft, the fan cover, the fan and the terminal box before the wound stator with the frame is transferred to the oven for the drying process. Place the wound stator in the oven heated to max. 120 °C for two hours. For larger motors a longer drying time may be required. After the drying process has been concluded, allow the stator to cool to room temperature. Measure the insulation resistance again as described in item 5.4. Repeat the stator drying process if the required insulation resistance does not meet the values specified in Table 5.3. If the insulation resistance does not improve despite several drying processes, evaluate the causes of the insulation resistance drop carefully and an eventual replacement of the motor winding may be required. If in doubt contact WEG.

To prevent electrical shock, discharge the motor terminals immediately before, and after each measurement. If the motor is equipped with capacitors, these must be discharged before beginning any repair.

### 8.5. SPARE PARTS

When ordering spare parts, always provide complete motor designation, indicating the motor type, the code number and the serial number, which are stated on the motor nameplate.

Spare parts must always be purchased from WEG authorized Service Centers. The use of non-original spare parts can cause motor failure, performance drop and void the product warranty.

The spare parts must be stored in a clean, dry and properly ventilated room, with relative air humidity not exceeding 60%, with ambient temperature between 5 °C and 40 °C, free of dust, vibrations, gases, corrosive smokes and at constant temperature. The spare parts must be stored in their normal mounting position without placing other components onto them.

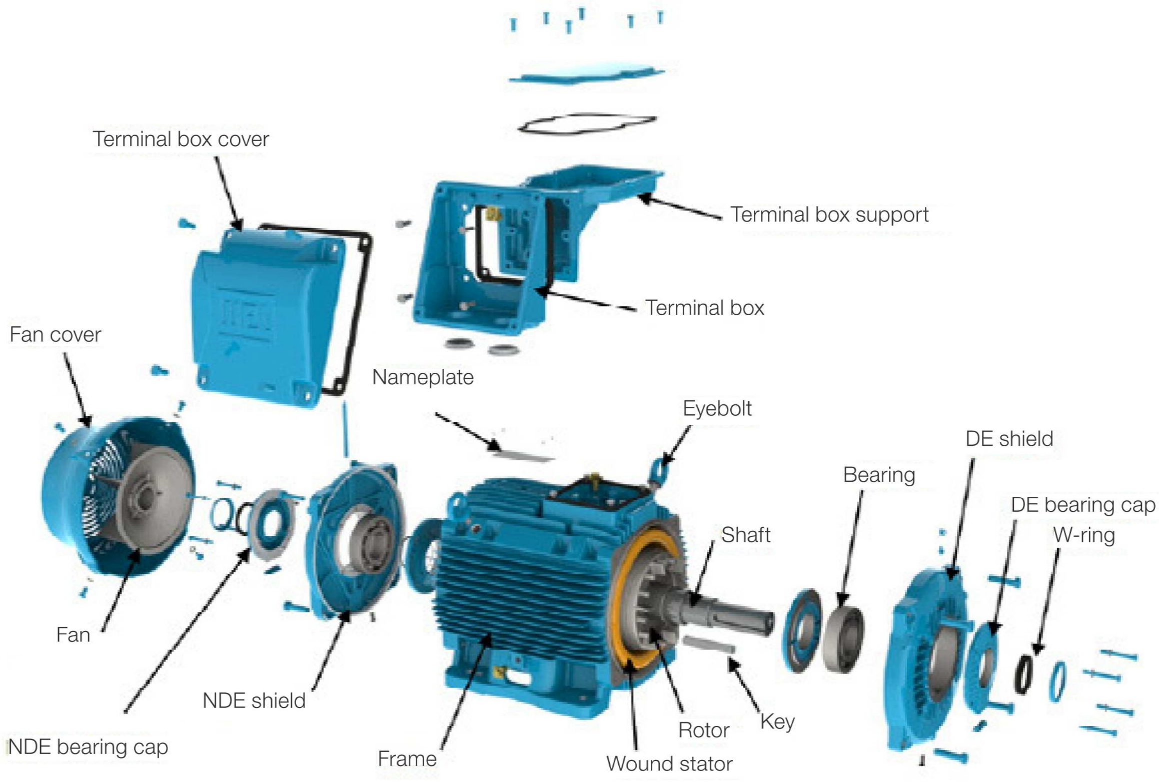


*__Figure 8.4__ - Exploded view of the components of a W22 motor*

# 9. ENVIRONMENTAL INFORMATION

## 9.1. PACKAGING

WEG electric motors are supplied in cardboard, plastic or wooden packaging. These materials can be recycled and must be disposed according to the applicable laws and regulations in each country. All wood used in the packaging of WEG motors come from the company reforestation program and is not submitted to any chemical conservation treatment.

## 9.2. PRODUCT

Electric motors consist mainly of ferrous metals (steel plates and cast iron), non ferrous metals (copper and aluminum) and plastic materials.

In general, electric motors have relatively long service live. However when they must be discarded, WEG recommends to dismantle the motor, sort the different materials and send them for recycling.

No-recyclable materials should be disposed of at industrial landfills according to the applicable environmental laws and regulations in each country, or co-processed in cement kilns or incinerated.

The recycling service providers, the disposal in industrial landfills, the waste co-processing or the incineration process must be properly authorized by the state environment agency to carry out these activities.

# 10. TROUBLESHOOTING CHART X SOLUTIONS

This troubleshooting chart provides a basic list of problems that may occur during motor operation, possible causes and recommended corrective actions. In case of doubts, please contact WEG Service Center.

| Problem | Possible cause | Corrective action |
|---|---|---|
| Motor does not start, neither coupled nor decoupled | Power cables are interrupted | Check the control panel and the motor power supply cables |
| | Blown fuses | Replace blown fuses |
| | Wrong motor connection | Correct the motor connection according to connection diagram |
| | Locked rotor | Check motor shaft to ensure that it rotates freely |
| The motor starts at no-load, but fails when load is applied. It starts very slowly and does not reach the rated speed | Load toque is too high during start-up | Do not start the motor on load |
| | Too high voltage drop in the power cables | Check the installation dimensioning (transformer, cable cross section, relays, circuit breakers, etc.) |
| Abnormal/excessive noise | Defective transmission component or defective driven machine | Check the transmission force, the coupling and the alignment |
| | Misaligned / unleveled base | Align / level the motor with the driven machine |
| | Unbalanced components or unbalanced driven machine | Balance the machine set again |
| | Different balancing methods used for motor and coupling balancing (halve key, full key) | Balance the motor again |
| | Wrong motor direction of rotation | Reverse the direction of rotation |
| | Loose bolts | Retighten the bolts |
| | Foundation resonance | Check the foundation design |
| | Damaged bearings | Replace the bearings |
| Motor overheating | Insufficient cooling | Clean air inlet and outlet and cooling fins |
| | | Check the minimum required distance between the fan cover and nearest walls. See item 7 |
| | | Check air temperature at inlet |
| | Overload | Measure motor current, evaluate motor application and if required, reduce the load |
| | Number of starts per hour is too high or the load inertia moment is too high | Reduce the number of starts per hour |
| | Power supply voltage too high | Check the motor power supply voltage. Power supply voltage must not exceed the tolerance specified in item 7.2 |
| | Power supply voltage too low | Check the motor power supply voltage and the voltage drop. Power supply voltage must not exceed the tolerance specified in item 7.2 |
| | Interrupted power supply | Check the connection of the power cables |
| | Voltage unbalance at the motor terminals | Check for blown fuses, wrong commands, voltage unbalance in the power line, phase fault or interrupted power cables |
| | Direction of rotation is not compatible with the unidirectional fan | Check if the direction of rotation matches the rotation arrow indicated on end shield |
| Bearing overheating | Excessive grease/oil | Clean the bearing and lubricate it according to the provided recommendations |
| | Grease/oil aging | |
| | The used grease/oil does not matches the specified one | |
| | Lack of grease/oil | Lubricate the bearing according to the provided recommendations |
| | Excessive axial or radial forces due to the belt tension | Reduce the belt tension |
| | | Reduce the load applied to the motor |

ENGLISH

# 11. WARRANTY TERM

WEG Equipamentos Elétricos S/A, Motors Unit ("WEG"), offers warranty against defects in workmanship and materials for its products for a period of 18 months from the invoice date issued by the factory or distributor/ dealer, limited to 24 months from the date of manufacture.
Motors of the HGF Line are covered for a period of 12 months from the invoice date issued by the factory or distributor / dealer, limited to 18 months from the date of manufacture.
The paragraphs above contain the legal warranty periods.
If a warranty period is defined in a different way in the commercial/technical proposal of a particular sale, that will supersede the time limits set out above.
The warranty periods above are independent of the product installation date and the startup.
If any defect or abnormal occurrence is detected during machine operation, the customer must immediately notify WEG in writing about the occurred defect, and make the product available for WEG or its Authorized Service Center for the period required to identify the cause of the defect, check the warranty coverage, and perform the proper repairs.
In order for the warranty to be valid, the customer must be sure to follow the requirements of WEG's technical documents, especially those set out in the product Installation, Operation and Maintenance Manual, as well as the applicable standards and regulations in force in each country.
Defects arising from the inappropriate or negligent use, operation, and/or installation of the equipment, non-execution of regular preventive maintenance, as well as defects resulting from external factors or equipment and components not supplied by WEG, will not be covered by the warranty.
The warranty will not apply if the customer at its own discretion makes repairs and/or modifications to the equipment without prior written consent from WEG.
The warranty will not cover equipment, components, parts and materials whose lifetime is usually shorter than the warranty period. It will not cover defects and/or problems resulting from force majeure or other causes not imputable to WEG, such as, but not limited to: incorrect or incomplete specifications or data supplied by the customer; transportation, storage, handling, installation, operation and maintenance not complying with the provided instructions; accidents; defects in the construction works; use in applications and/or environments for which the machine was not designed; equipment and/or components not included in the scope of WEG supply. The warranty does not include disassembly services at the buyer's premises, product transportation costs and travel, lodging and meal expenses for the technical staff of the Service Centers, when requested by the customer.
The services under warranty will be provided exclusively at WEG authorized Service Centers or at one of its manufacturing plants. Under no circumstances will the warranty services extend the equipment warranty period.
WEG's Civil Liability is limited to the supplied product; WEG will not be liable for indirect or consequential damages, such as losses of profit and revenue losses and alike which may arise from the contract signed between the parties.

# 12. EC DECLARATION OF CONFORMITY

**WEG Equipamentos Elétricos S/A**
Av. Prefeito Waldemar Grubba, 3000
89256-900 - Jaraguá do Sul – SC – Brazil,

and its authorised representative established in the European Community,
**WEGeuro – Industria Electrica SA**
Contact person: Luís Filipe Oliveira Silva Castro Araújo
Rua Eng Frederico Ulrich, Apartado 6074
4476-908 – Maia – Porto – Portugal

hereby declare that the products:

WEG induction motors and components for using in these motors:

Three-phase
**IEC frames 63 to 630**
**Nema frames 42, 48, 56 and 143 to 9610**
……………
Single-phase
**IEC frames 63 to 132**
**Nema frames 42, 48, 56 and 143 to 215**
……………

when installed, maintained and used in applications for which they were designed, and in compliance with the relevant installation standards and manufacturer's instructions, comply with the requirements of the following European Directives and standards where applicable:

Directives:
**Low Voltage Directive 2006/95/EC***
**Regulation (EC) No 640/2009***
**Directive 2009/125/EC***
**Machinery Directive 2006/42/EC****
**EMC Directive 2004/108/EC** (inductions motors are considered inherently benign in terms of electromagnetic compatibility)

Standards:
**EN 60034-1:2010/ EN 60034-2-1:2007/EN 60034-5:2001/A1:2007/ EN 60034-6:1993/ EN 60034-7:1993/A1:2001/ EN 60034-8:2007/ EN 60034-9:2005/A1:2007/ EN 60034-11:2004/ EN 60034-12:2002/A1:2007/ EN 60034-14:2004/A1:2007/ EN 60034-30:2009, EN 60204-1:2006/AC:2010 and EN 60204-11:2000/AC:2010**

CE marking in: **1996**
* Electric motors designed for use with a voltage rating higher than 1,000 V are not considered under the scope.
** Low voltage electric motors are not considered under the scope and electric motors designed for use with a voltage rating higher than 1,000 V are considered partly completed machinery and are supplied with a

**Declaration of Incorporation:**

*The products above cannot be put into service until the machinery into which they have been incorporated has been declared in conformity with the Machinery Directive.*

*A Technical Documentation for the products above is compiled in accordance with part B of annex VII of Machinery Directive 2006/42/EC.*

*We undertake to transmit, in response to a reasoned request by the national authorities, relevant information on the partly completed machinery identified above through WEG authorised representative established in the European Community. The method of transmission shall be electronic or physical method and shall be without prejudice to the intellectual property rights of the manufacturer.*

Milton Oscar Castella
*Engineering Director*

Jaraguá do Sul, April 8th, 2013